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INSTRUCTION MANUAL

# MODEL 134
# SWEEP GENERATOR

WAVETEK

# Product Improvement Notice

Wavetek maintains a continuing program to make improvements to their instruments that will take advantage of the latest electronic developments in circuitry and components.

Due to the time required to document and print instruction manuals, it is not always possible to incorporate these changes in the manual.

Wavetek has manufactured your instrument, using metal film 1% tolerance resistors in place of 5% carbon resistors, wherever practical. This results in a substantial improvement in the overall performance of your instrument. Therefore, there may exist a discrepancy between the resistor used to manufacture your instrument and the resistor called out in the Parts List and Schematic Diagrams in this manual.

If field replacement of an affected resistor does become necessary, replacement may be made in accordance with the manual call outs. Wavetek, however, recommends replacement with the same type of resistor used in the manufacture of your instrument, whenever possible.

# WARRANTY

All Wavetek instruments are warranteed against defects in material and workmanship for a period of one year after date of manufacture. Wavetek agrees to repair or replace any assembly or component (except batteries) found to be defective, under normal use, during this period. Wavetek's obligation under this warranty is limited solely to repairing any such instrument which in Wavetek's sole opinion proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Transportation to the factory or service center is to be prepaid by purchaser. Shipment should not be made without prior authorization by Wavetek.

This warranty does not apply to any products repaired or altered by persons not authorized by Wavetek, or not in accordance with instructions furnished by Wavetek. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

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## SCOPE OF MANUAL

This manual contains instructions for operating, testting, and maintaining the Wavetek Model 134 Sweep Generator. The Wavetek product-improvement program ensures that the latest electronic developments are incorporated into the Wavetek instruments by the addition of circuit and component changes as rapidly as development and testing permit. Due to the time required to document and print this manual, it is not always possible to incorporate these changes into the manual. In this case, data will be found on engineering change sheets at the back of the manual. If there are no change sheets, the manual is correct as printed.

## SCOPE OF EQUIPMENT

The Model 134 is a precision source of sine, square, triangle, and sawtooth waveforms with selectable and variable outputs over a dynamic frequency range of 0.2 Hz to 2 MHz. The instrument also offers frequency control by external voltage for either dc programming or wideband ac modulation. Additionally, the Model 134 can be operated as a triggered or gated CW generator and as a continuous or triggered sweep generator.

# SECTION 1
# SPECIFICATIONS

## VERSATILITY

**Waveforms**
Sine ∿, square ⊓, triangle △, and sweep ◿.

**Dynamic Frequency Range**
0.2 Hz to 2 MHz.

**Ranges**

| | |
|---|---|
| X10 | 0.2 Hz to 20 Hz |
| X100 | 2 Hz to 200 Hz |
| X1K | 20 Hz to 2 kHz |
| X10K | 200 Hz to 20 kHz |
| X100K | 2 kHz to 200 kHz |
| X1M | 20 kHz to 2 MHz |

**Outputs**
Sine ∿, square ⊓, triangle △, and sweep ◿, selectable; amplitude variable over 40 dB, 50Ω output impedance (600Ω available); 20 V p-p into open circuit and 10 V p-p into 50Ω load from 50Ω source impedance. Separate ramp output at 5 volts peak and 600Ω impedance.

**Sync Output**
Greater than 1 V p-p square wave into open circuit at 600Ω output impedance.

**DC Offset**
±5 V offset (±2.5 V offset into 50Ω load) controlled from rear panel; peak amplitude limited by the dynamic range of the amplifier output.

**VCG—Voltage Controlled Generator**
Frequency of generator may be dc-programmed or ac-modulated by external 0 ±5 V signal. Voltage control circuitry is capable of 1000:1 frequency variation without changing ranges. The VCG amplifier has a 100 kHz bandwidth and a slew rate of 0.1 V/μs. The instantaneous frequency is the result of the sum of the dial setting and the externally applied voltage.

**Stability**

| | |
|---|---|
| Short term | ±0.05% for 10 minutes |
| Long term | ±0.25% for 24 hours |

Percentages apply to amplitude, frequency, and dc offset.

## OPERATIONAL MODES

**Continuous***
Operates as a standard VCG. Frequency determined by dial/vernier/range settings in parallel with VCG input.

**Trigger****
One complete cycle is generated by applying a pulse to the trigger input.

**Gated****
Same as trigger except that cycles continue for the duration of input gate.

**Continuous Sweep**
The main generator is frequency modulated by the sweep generator. When swept, the main generator frequency rises from the frequency set by the dial and range settings to a frequency selected by the sweep-width controls. Sweep rate is set by panel controls.

*Both generators free run.
**Sweep generator free runs, main generator is triggered or gated.

**Trigger Sweep**
Same as continuous sweep mode except one complete sweep cycle is generated for each input trigger pulse. Main generator continues to oscillate between sweep cycles.

**Tone-Burst**
Main generator is gated by the sweep output (internally connected). The tone-burst rate, frequency, and length can be independently controlled.

**Trigger Input**
1 V peak into 10 kΩ impedance dc coupled to 200 kHz, proportionally greater at higher frequencies.

**Sweep Time**
10 μs to 100 s.

**Sweep Width**
Up to 1000:1 with calibrated control.

## HORIZONTAL PRECISION

**Dial Accuracy**
±2% of full scale, 1 Hz to 2 MHz.

**Electronic Frequency Vernier**
One turn for approximately 1% of full-scale change.

**Time Symmetry**
±1% through X100K range.

## VERTICAL PRECISION

**Sine Wave Frequency Response**
Amplitude change with frequency less than:
0.1 dB from 0.2 Hz to 200 kHz
0.5 dB from 0.2 Hz to 2 MHz

## PURITY

**Sine Wave Distortion**
Less than:
0.5% on X10, X100, X1K, X10K ranges
1.0% on X100K range
2.0% on X1M range

**Square Wave Rise and Fall Time**
Less than 100 ns.

## ENVIRONMENTAL

**Temperature**
All specifications listed, except stability, are for 25°C ±5°C. For operation from 0°C to 55°C, derate all specifications by factor of 2.

## MECHANICAL

**Dimensions**
8-½ inches wide, 5-¼ inches high, 11-½ inches deep.

**Weight**
8 lb net, 11 lb shipping.

**Power**
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz.
Less than 20 watts.

*NOTE*

*All specifications apply for frequencies obtained when dial is between 0.1 and 2 and at 10 V p-p into a 50Ω load.*

# SECTION 2
# OPERATION

## INSPECTION

The following procedures should be performed to assure the user that the instrument has arrived at its destination in proper operating condition. Complete calibration and maintenance instructions are provided in Section 4.

### Checking Visually

After carefully unpacking the instrument, visually inspect the external parts for damage to knobs, dials, indicators, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the instrument. Retain the shipping container and packing material for use in case reshipment is required.

### Checking Electrically

*NOTE*

*Instruments are normally shipped connected for 115 V power unless 230 V power is ordered. Refer to the end of this section for conversion instructions.*

The procedural steps in this paragraph provide a quick checkout of instrument operation. If electrical deficiencies exist, refer to the Warranty in the front of this manual. The following test equipment, or equivalent, is recommended for performing this electrical inspection. (Refer to Operating Controls and Figure 2-1 for operating control descriptions.)

| Name | Manufacturer | Model |
|---|---|---|
| Oscilloscope | Tektronix | 544 |
| Counter-Timer | Monsanto | 101A |

1. Turn FREQ HZ selector to the X1K position. (This connects ac power to the unit and establishes the frequency multiplier).
2. Connect oscilloscope to the 50Ω OUT connector with 50-ohm terminator.
3. Set frequency dial to the 1.0 mark and MODE selector to CONT.
4. Set function selector to ∿ .
5. Rotate 20 V P-P MAX control to its maximum clockwise position.
6. Check for 1-kHz sine wave with greater than 10 V p-p amplitude on oscilloscope.
7. Select ⩘ and ⎍ with function selector and check for 10 V p-p amplitude on oscilloscope.
8. Turn frequency dial from maximum counterclockwise to maximum clockwise positions and check for frequency change.
9. Rotate 20 V P-P MAX control from maximum clockwise to maximum counterclockwise positions and check for decreasing amplitude.
10. Rotate VERNIER to maximum cw position. Set frequency to 20 Hz with counter. Connect 0 to +5 Vdc input to the VCG IN connector. Slowly increase voltage input from 0 to maximum and check that frequency of output waveform increases approximately from 20 Hz to 2 kHz.
11. Set MODE selector to TRIG. Disconnect power supply from VCG IN connector. Rotate TRIG LEVEL control while observing oscilloscope. One cycle of the desired waveform should appear.
12. Set MODE selector to GATED. Rotate TRIG LEVEL control while observing oscilloscope. Waveform should appear at cw position and disappear at ccw position.
13. Set MODE selector to CONT SWP. Set frequency to 20 Hz with counter. Set SWEEP WIDTH to 2.0. Set SWEEP TIME to 1S. Displayed frequency should sweep recurringly from 20 Hz to 2 kHz at a 1 Hz rate.
14. Set MODE to TRIG SWP. Rotate TRIG LEVEL control, while observing oscilloscope. Displayed frequency should sweep once from 20 Hz to 20 kHz in 1 second.
15. Set MODE selector to TONE BURST. Rotate TRIG LEVEL control, while observing oscilloscope. Tone bursts at 20 Hz should appear with burst duration varying with rotation of TRIG LEVEL control.
16. Connect oscilloscope to SWEEP OUT connector. Set MODE selector to CONT. Set SWEEP TIME to 1 mS. Oscilloscope should display a 2-kHz square wave. ⇒ SAW TOOTH
17. Connect oscilloscope to SYNC OUT connector. Set frequency dial to 2.0. Oscilloscope should display a 2-kHz square wave.

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*NOTE*

*With the frequency dial in the extreme CW position (the bottom of the dial) and with the frequency VERNIER control turned fully CCW it is possible for the generator to stop oscillating. This is well below 1/1000th of the top of the dial. This condition is easily corrected by turning the frequency VERNIER control in a clockwise direction until oscillation again occurs.*

*It is also possible to stop the generator from oscillating by applying a negative voltage to the VCG summing node when the MODE selector switch is set to TRIG SWP and the SWEEP WIDTH control is set to maximum. If the generator stops oscillating, turn the frequency dial counterclockwise until oscillation again occurs. This condition is well below 1/1000th of the top of the dial. Do not attempt to purposely stop the generator in this manner.*

## OPERATING CONTROLS

The operating controls and electrical connections for the Model 134 are shown in Figure 2-1. The listing below discusses each control and its function.

1. **FREQ HZ/Power Switch** — This 7-position switch selects the generator frequency range. The extreme counter-clockwise position is the power off position.

2. **FREQUENCY VERNIER** — This control allows precision control over the output frequency. When frequency dial is set at .02 (1/100 of range) VERNIER controls frequency to approximately .002 (1/1000 of range). When in the full clockwise position (CAL), the settings on the main dial will be calibrated.

3. **FREQUENCY DIAL** — The main frequency control. The setting on this dial multiplied by the frequency range setting (above) equals the output frequency of the generator. The frequency VERNIER also affects the generator frequency.

4. **FREQUENCY INDEX** — The scribe line indicates the frequency dial setting. The index is illuminates when the unit is on.

5. **FUNCTION SELECTOR** — This selects the waveform that appears at the 50Ω OUT connector. The waveforms are sine ∿, triangle ∿, square ⊓⊔, or sweep ⊿.

6. **AMPLITUDE VERNIER** — A vernier control of the output amplitude. Maximum clockwise position gives the full output amplitude of 20 V peak-to-peak into an open circuit or 10 V p-p into a 50Ω load. Counter-clockwise rotation will continuously reduce the output amplitude. The control gives a minimum of 40 dB variation (100:1). For maximum output amplitude this vernier must be full clockwise.

7. **50Ω. OUT** — This connector provides the selected generator output function. The generator may operate into an open circuit providing 20 V peak-to-peak maximum, or into a 50Ω load providing a 10 V peak-to-peak output.

8. **SWEEP OUT** — When the generator is in CONT, TRIG, GATED, CONT SWP, or TONE BURST mode, output provides a fixed 0 to +5 V sawtooth output. The frequency of this output is controlled by the SWEEP TIME controls (9). When the generator is in TRIG SWP mode, the output becomes a single cycle sawtooth, triggered by the TRIG IN (13).

9. **SWEEP TIME and VARIABLE** — Determines the frequency of the sawtooth generator appearing at the SWEEP OUT. The frequency of this generator is independent of the frequency of the main generator. When in any of the sweep modes, this sawtooth determines the duration of the sweep cycle. The SWEEP TIME (larger) knob determines the frequency range and the VARIABLE (smaller) knob provides a fine adjustment. Note that the larger switch detent position is located between two time ranges. With the VARIABLE in the full clockwise position, the sweep time is equal to the time to the right of the detent setting. However, moving the VARIABLE to the full counter clockwise results in the sweep time approximately 100 times the SWEEP TIME.

10. **SWEEP WIDTH and VARIABLE** — Determines the amount of sweep when in CONT SWP or TRIG SWP. The SWEEP WIDTH (large) knob has ten detent positions which are located between two sweep widths. With the VARIALBE in the full clockwise position the sweep

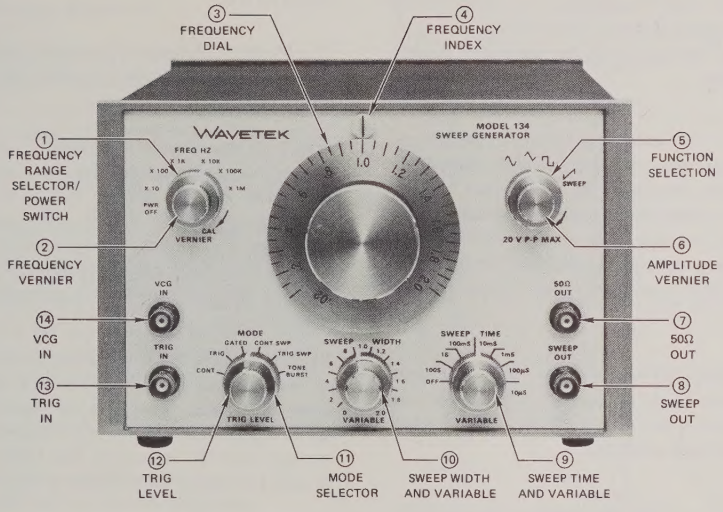



Figure 2-1. Operating Controls

width is equal to the sweep width to the right of the detent setting. Moving the VARIABLE to the full counter clockwise results in the approximate sweep width to the left of the detent. Clockwise rotation of either knobs increases sweep width, counter clockwise rotation decreases sweep width.

11. **MODE SELECTOR** — Selects the operating mode of the main generator as follows:
   a) CONT = Continuous Mode. The generator operates at a fixed frequency and runs continuously. The SWEEP OUT is a fixed 0 to +5 V sawtooth.
   b) TRIG = Trigger Mode — The generator will give one complete cycle of output for each pulse applied to the TRIG IN connector. Since the SWEEP OUT can be operated independently, it can be used as a convenient source. Manual triggering can be accomplished by rotating the Trig Level Control (12) from full CCW to full CW. The SWEEP OUT is a fixed 0 to +5 V sawtooth.
   c) GATED = Gated Mode — Operates the same as triggered mode except that the generator will continue to have output for the full time that the signal at the TRIG IN connector exceeds the gating level. See TRIG LEVEL (12). The SWEEP OUT is a fixed 0 to +5 V sawtooth.
   d) CONT SWP = Continuous with Sweep Mode. The main generator operates continuously and repetitively sweeps from the minimum to maximum frequency as determined by the sweep controls.
   e) TRIG SWP = Triggered Sweep Mode — The main generator oscillates at the start or low frequency until a trigger signal is applied. The frequency then sweeps to the maximum frequency as determined by sweep width control and then returns to the low frequency until another trigger is applied. The SWP OUT is a single cycle sawtooth, triggered by the TRIG IN (13).
   f) TONE BURST = Internal Gated Mode — Operates the same as the GATED mode with no TRIG IN input.

12. **TRIG LEVEL** — Adjusts the sensitivity of the trigger input circuitry. When in the full counter clockwise position, approximately —7.5 V is required for triggering. In the full clockwise position approximately +7.5 V is required for triggering. At the mid point, extremely low voltages will trigger the instrument. By rotating the knob, it is possible to manually trigger the generator. In the GATED mode, the generator will begin to run continuously as the control is rotated past the mid-point in a clockwise direction.

13. **TRIG IN** — DC coupled input with 10 kΩ input impedance. The TRIG LEVEL control adjusts the sensitivity of the generator to this input signal.

14. **VCG IN** — This connector allows external control of frequency. With 0 volts in, the generator output frequency is determined by the frequency range selected and the frequency dial setting. A positive VCG voltage will increase this frequency, and a negative voltage will decrease the frequency. Input impedance is 5 kΩ.

**DC OFFSET** — This rear panel control adjusts the amount of dc or baseline offset above or below signal ground. The detent position gives normal vertical symmetry.

**SYNC OUT** — This rear panel output provides a synchronizing wave output at the same frequency of the main generator. The output amplitude is greater than 1 V p-p into open circuit at 600Ω output impedance.

### *GENERAL NOTES*

*One-half hour warmup is required for generator to stabilize at specified accuries.*

*A 50-ohm termination results in 10 V p-p maximum output level. Open-circuit termination gives 20 V p-p. Loads between these limits provide intermediate maximum output levels.*

*The frequency VERNIER control must be in full cw position for calibrated-frequency operation over the .1 to 2 dial range. If this control is in full ccw position, dial range is uncalibrated, but extended to approximately 1/1000 of full scale.*

*A 1-volt peak signal is required for trigger rates up to 200 kHz. Proportionally higher voltage is required for higher frequencies.*

## OPERATION

The Model 134 Sweep Generator can operate in the following six operational modes, as selected by the mode switch setting.

**CONT — Continuous Frequency Operation** provides a fixed-frequency output for the selected frequency, amplitude, and waveform. The output frequency is determined by the FREQ HZ range selector and frequency dial settings. Output amplitude is controlled with the 20 V P-P MAX continuously-variable potentiometer, and the waveform is selected by the function selector.

**TRIG — Trigger Operation** provides a one-cycle output of the selected waveform with the application of an external trigger. The external signal may be either ac or stepped dc from +1 volt to +12 volts, applied at the TRIG IN connector. The TRIG LEVEL control is used to establish the threshold bias.

**GATED — Gated Operation** provides a multicycle output of the selected waveform, frequency, and amplitude when an external signal is applied to the TRIG IN connector. Burst duration is a function of external signal duration.

**CONT SWP — Continuous Sweep Operation** provides an internally-generated, sweep frequency output of the selected waveform, amplitude, and low-end frequency. Sweep width and sweep time are selected in conjunction with the low-frequency limit established by the setting of the frequency dial and FREQ HZ range selector. The output frequency increases from the lower frequency to the upper frequency, which is established by the setting of the SWEEP WIDTH selector, at the rate set by the SWEEP TIME selector. When the upper frequency is reached, the output frequency returns rapidly to the lower limit and the cycle is repeated.

**TRIG SWP — Trigger Sweep Operation** provides a sweep-frequency output at the selected frequency, amplitude, and waveform each time an external signal is applied to the TRIG IN connector. Sweep width and time are selectable as in continuous sweep operation, but the sweep cycle is not repeated until another external trigger arrives.

**TONE BURST — Tone Burst Operation** provides internally-generated, recurring bursts of fixed frequencies. Burst duration is adjustable with the TRIG LEVEL control. Frequency, amplitude, and waveform are selected as in continuous frequency operation.

**Operating as a Function Generator**

1. Set MODE selector to CONT position.
2. Set function selector for desired waveform.
3. Set FREQ HZ range selector to desired multiplier.
4. Set desired frequency dial mark under illuminated index.
5. Set 20 V P-P MAX control for desired output level.
6. If triggered/gated operation is desired, inject a 1-volt peak signal into TRIG IN connector with MODE selector in TRIG or GATED position. Trigger operation provides one cycle of the selected waveform for each step-voltage input. Gated operation produces a tone burst with its duration equal to the duration of the step voltage.

**Operating as a Voltage Controlled Generator (VCG)**

1. Set MODE selector to CONT position.
2. Set function selector for desired waveform.
3. Set FREQ HZ range selector to desired multiplier.
4. Connect external voltage source (dc programming or wideband ac signal) to VCG IN connector.

*NOTE*

*VCG input requires 0 to ±5 volts for operation over full-scale range, but can withstand many times maximum input.*

*A negative voltage applied to the VCG input with the dial at the bottom may cause the generator to stop oscillating. Operation in such a manner is not recommended.*

5. Set frequency dial as follows:
   a. For frequency modulation with ac input, set dial for center frequency.
   b. For increasing frequency sweep with positive dc input, set dial to lower frequency limit.
   c. For decreasing frequency sweep with negative dc input, set dial to upper frequency limit.
6. Set 20 V P-P MAX control for desired output level.
7. The nomograph in Figure 2-2 shows the characteristics of the VCG circuit. Column A gives the frequency dial setting; column B, the VCG input voltage; and column C, the approximate equivalent dial frequency. Column C must be multiplied by the frequency range multiplier for the actual output frequency.

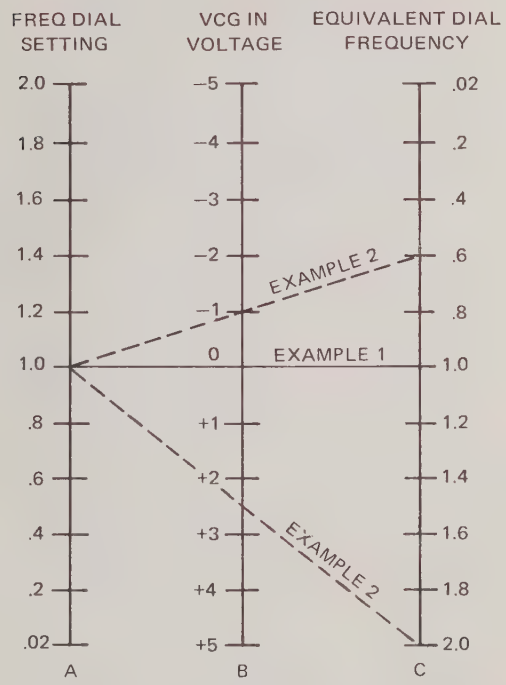



Figure 2-2 - VCG Voltage-to-Frequency Nomograph

In example 1, the dial is set at 1, and 0 volts is applied to the VCG input. Extend a straight line from 1 (dail setting) through 0 volts (VCG voltage) and obtain an equivalent dial frequency of 1. For the total output frequency, multiply the range by 1. With the same dial setting, example 2 shows the results of using a ramp from −1 volt to +2.5 volts for the VCG voltage. This results in a swept output from 0.6 to 2.0. Remember to multiply these equivalent dial frequencies by the range.

**Operating as a Sweep Generator.**

1. Set MODE selector to CONT SWP.
2. Set function selector for desired waveform.
3. Set FREQ HZ range selector to desired multiplier.
4. Set the SWEEP TIME control to the desired sweep time. The sweep time control operates in the following manner. The larger knob provides the coarse adjustment. There are 7 detent positions covering sweep times from 100 s to 10 μs. The VARIABLE control is a vernier covering

sweep times between one or more detent positions. When the VARIABLE control is in the full CW position, the sweep time is equal to the time indicated at the right of detent mark.

5. Set the SWEEP WIDTH to the desired sweep width. This control is operated as described below.

   To read the sweep width control, notice that the larger knob has ten detent positions located between the numbers appearing on the panel.

   The VARIABLE vernier covers the range between the numbers on either side of the detent. For example, if the detent is set between .6 and .8, the VARIABLE in the full CCW position gives a sweep width of .6 and in the full CW position, a width of .8.

   The sweep width is determined by adding the frequency set by the main dial to the value determined by the sweep width control. Here are two examples:

Example 1

Suppose you want to sweep from 10 kHz to 30 kHz. Set the main dial on 1.0 and the range on X10K. The starting frequency is now set at 10K. Now determine what number must be added to the number on the dial so that the sum times the frequency range multiplier equals the top frequency of 30 kHz. Therefore 1.0 (dial value) +2.0 (sweep width) equal 3.0 and X10 kHz = 30 kHz. Set the SWEEP WIDTH knob in the detent between 1.8 and 2.0 with the VARIABLE in the CW position to give a sweep width of 2.0.

Example 2

Now sweep from 20 Hz to 20 kHz. Since this is a sweep range of 1000:1 the dial must be set at the bottom. The reason for this is that the top frequency cannot exceed the top of the dial multiplied times the range. Therefore, the bottom of the dial is set at .02 and the frequency vernier is rotated maximum CCW to give the additional 10:1. The frequency range switch is set at X10K since 10K times .002 equals 20 Hz, the starting frequency. As in the previous example, the SWEEP WIDTH must be set to 2.0 since .02 (dial) + 2.0 (sweep width) equals 2.02 and X10 kHz (range multiplier) = 20 kHz, the top frequency.

6. Set 20 V P-P MAX control for desired output level.
7. If triggered-sweep operation is desired, inject a 1 volt peak signal into the TRIG IN connector with MODE selector in TRIG SWP position. Trigger-sweep operation provides one frequency excursion of the selected waveform for each step-voltage input.

**Operating as a Tone Burst Generator**

1. Set the MODE selector to TONE BURST.
2. Set function selector to desired waveform.
3. Set the frequency of the carrier by the main dial.
4. Set the duration of the burst (number of cycles per burst by varying the TRIG LEVEL.
5. Set the repetition rate with the SWEEP TIME control.
6. Set the 20 V P-P MAX control for the desired output level.

**Operating as a Ramp Generator**

1. Connect coaxial cable between SYNC OUT (on rear panel) and TRIG IN connectors.
2. Set function selector to sweep ⟋ .
3. Set SWEEP WIDTH to 0.
4. Set SWEEP MODE to TRIG SWP.
5. Adjust TRIG LEVEL control for sweep generator firing point.
6. Set ramp parameters as follows:
   a. Repetition rate with FREQ HZ selector and frequency dial.
   b. Ramp amplitude with 20 V P-P MAX control.
   c. Ramp slope with SWEEP TIME controls.
   d. Ramp baseline with DC OFFSET potentiometer.

**Converting to 230-Volt Line Power**

The Model 134 Sweep Generator is shipped from the factory with the power transformer connected for 115-volt line power, unless ordered for 230-volt use. Converting a 115-volt unit for 230-volt operation is a simple matter:

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel and remove panel.
3. The conversion switch is located on the chassis. Use a thin-bladed screwdriver to move the 115-230 switch to the 230 position.
4. Replace 1/4-ampere fuse with a 1/8-ampere fuse of the same type.

### Connecting Signal and Chassis Grounds

The instrument is shipped from the factory with the signal ground floating above chassis ground, unless otherwise specified. A common signal/chassis ground can be obtained as follows:

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel. Remove panel and cover.
3. Solder a jumper wire between the ground lugs (green wires) of the SYNC OUT connector and the power connector (Figure 2-3).

### Converting Output Impedance to 600 Ohms

Unless otherwise specified, this instrument was shipped with 50 ohm output impedance. If the application calls for a 600 ohm output, use the following steps for conversion:

1. Remove R165, R166, R167, R168, R169 and C67.
2. Replace R165 with a 1000 ohm (1% tolerance) resistor and jumper R166; replace R167 with a 1500 ohm (1% tolerance) resistor and jumper R168. (Parallel equivalent is 600 ohms.)
3. Let R169 and C67 remain vacant.

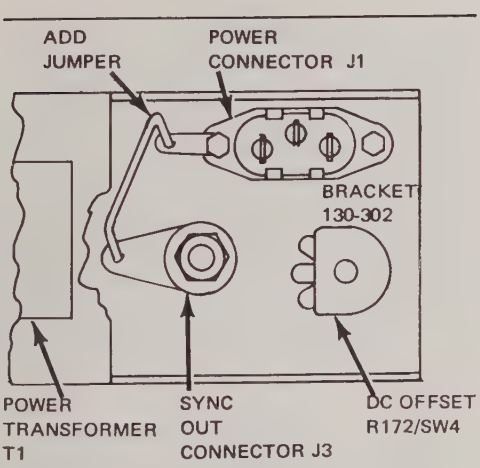



Figure 2-3. Common Ground Connection Diagram

# SECTION 3
# CIRCUIT DESCRIPTION

## GENERAL DESCRIPTION

### Main Generator

The basic generator circuitry (Figure 3-1) consists of the integrator and hysteresis/output switch. The square wave from the output switch is applied to the VCG circuit where it gates a current, which is proportional to the sum of the VCG input, frequency dial, and vernier control voltages, into the integrator summing node. The integrator transforms the square wave into a triangle wave that is applied to the hysteresis switch. The hysteresis/output switch functions similarly to a Schmitt trigger with its limit points set far apart. When a limit point is reached, the hysteresis/output switch fires and reverses the polarity of the square wave into the integrator, causing the triangle waves of the same frequency, having the positive portion of the square wave coincident with the negative slope of the triangle.

Oscillation frequency is determined by a timing capacitor selected by the frequency range switch and the integrating current controlled by the frequency/vernier potentiometers. The main generator trigger circuit is disconnected in the continuous-frequency operation just described. When a triggered, gated, or tone-burst operation is selected, this circuit places a shunt path between the integrator input and output. Therefore, there is no output at the 50-ohm BNC until an external trigger/gate signal is applied to the trigger input connector; or, for tone burst mode, an internal gate voltage is generated by the sweep circuitry. A trigger input enables the generator for one complete cycle of the selected waveform, than the main generator is disabled again until another trigger arrives. A gate input allows the generator to function for the duration of the gate. For tone bursts, the selected waveform appears automatically at the 50-ohm BNC as a gated signal with the gate duration established by the internally-generated sawtooth waveform.

The triangle output of the integrator is transformed into a sine wave by the sine converter circuitry. The selected waveform is amplified by the output amplifier and connected to the 50-ohm BNC.

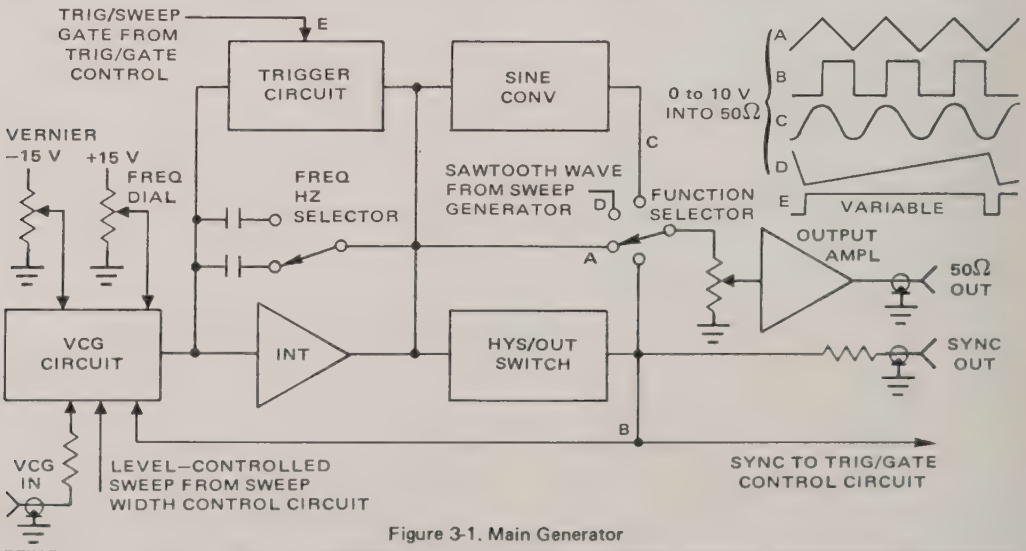



Figure 3-1. Main Generator

**Sweep Generator**

Figure 3-2 presents a functional block diagram of the sweep/gating circuitry to supplement the following discussion. When operating in the continuous frequency, continuous sweep, or triggered sweep mode, the output of the trigger/gate control circuit disconnects the main-generator trigger circuit and the main generator initially produces an output frequency that is a function of the frequency dial setting, frequency-range selector, frequency-vernier control, and VCG input voltage. In triggered-sweep operation, the output frequency begins to increase when a trigger pulse is applied to the trigger input BNC. Rate of change from the low to high limit is a function of the sweep time control settings. This switch connects different values of capacitance into the feedback path of the sweep integrator so that its sawtooth output varies in frequency and produces the selected time interval. The output sawtooth of the sweep generator is connected to the sweep output BNC, to the function selector, and to the sweep width control. This control connects different values of resistors to the VCG input circuit so that the sawtooth input varies in peak current as a function of the selected sweep width. If the frequency controls are set for 2 kHz (X 100 kHz range), sweep time for 1 ms, and sweep width for 2.0, the selected waveform at the 50-ohm BNC will swing from 2 kHz to 200 kHz in 1 ms each time a trigger occurs. Continuous sweep operation with these settings produces a recurring 2 kHz to 200 kHz output at a 1 kHz repetition rate. The mode switch disconnects the sawtooth from the VCG circuit in the continuous, triggered, gated, and tone-burst modes. Gated operation direct couples the external gating pulse from the trigger input BNC to the trigger/gate control circuit which, in turn, disconnects the main generator trigger circuit for the duration of the external signal. Trigger operation places capacitance between the comparator and control circuit to differentiate the external pulse and momentarily disconnects the trigger circuit, allowing one cycle of the selected frequency to be produced by the main generator.

During tone-burst operation, the sweep generator output is connected to the trigger comparator input. Since the sweep-width control circuit disconnects the sawtooth from the VCG input in this mode, the tone-burst output is a fixed frequency with the burst duration established by the setting of the trigger level control.

The hysteresis/output switch synchronizing pulse applied to the trigger/gate control circuit prevents this circuit from reconnecting the main generator disable before a full cycle is completed.

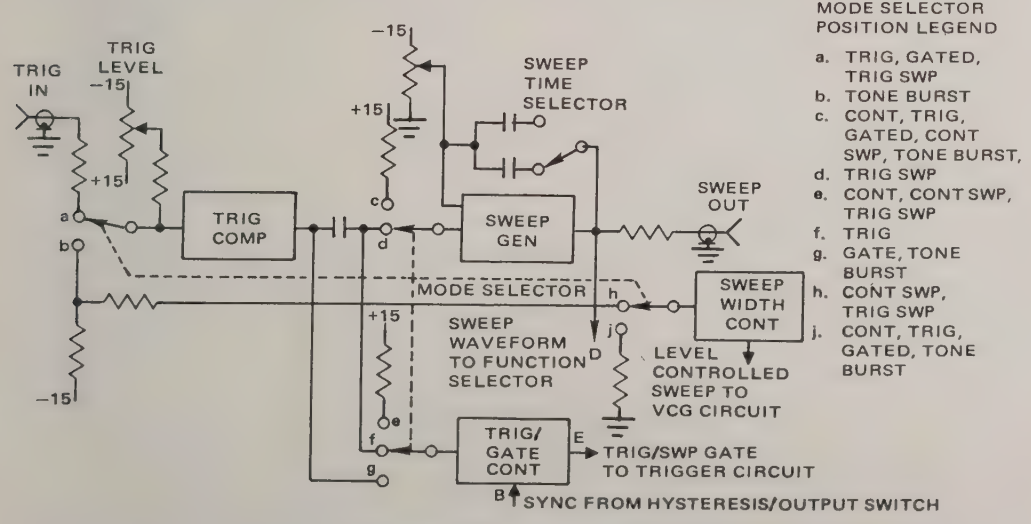



Figure 3-2. Sweep Generator

# SECTION 4
# MAINTENANCE

## INTRODUCTION

This section provides instructions for testing, calibrating, troubleshooting, and repairing the Model 134. The instructions are concise and for the experienced electronics technician or field engineer. Wavetek maintains a factory-repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to decrease the turnaround time. Test point and adjustment locations are illustrated in Section 5.

## RECOMMENDED TEST EQUIPMENT

Table 4-1 contains a list of recommended test equipment. Any test equipment having equivalent accuracies may be substituted for those listed.

**Table 4-1. TEST EQUIPMENT**

| Name | Required Characteristics | Recommended Manufacturer | Model |
|---|---|---|---|
| Oscilloscope | To 30 Mhz | Tektronix | 544 |
| Plug-In | Dual channel | Tektronix | 1A1 |
| Plug-In | Peak Mv measuring capability | Tektronix | 1A5 |
| Distortion Analyzer | To 600 kHz | Hewlett-Packard | 334A |
| Spectrum Analyzer Display | To 50 MHz | Hewlett-Packard | 141S |
| IF Section | | Hewlett Packard | 8552A |
| RF Section | | Hewlett Packard | 8553L |
| Voltmeter | Millivolt dc measurement | 1 mV Resolution | |
| Counter | To 10 MHz | 0.1% of reading accuracy | |

## CHECKOUT AND CALIBRATION

The following paragraphs provide complete sequential calibration procedures for the Model 134. Instrument checkout procedures are indicated by a checkmark (✓) following the procedure title. A quick checkout of the instrument can be performed by comparing the indicated parameters with the tolerances given in the Specifications of Section 1.

*NOTE*

*The entire calibration procedure must be read first to determine initial control settings and test equipment connections before attempting checkout.*

### Preliminary Procedures

1. Set FREQ HZ selector to the X1K position, dial at 2.0, and VERNIER control maximum cw.
2. Set MODE selector to CONT, SWEEP WIDTH to 1.0, and SWEEP TIME to 1 mS.
3. Allow one-half hour for warmup.
4. After warmup, set SWEEP WIDTH and SWEEP TIME to off, both variables full cw.

## REMOVAL OF DUST COVERS AND PANELS

1. To gain access for calibration or maintenance, proceed as follows:
   a. Remove power cord.
   b. Loosen the two knurled captive screws on the rear panel.
   c. Pull off the rear panel.
   d. Remove the cover.
2. To gain access to any part mounted on bracket assembly behind rear panel, proceed as follows:
   a. Remove rear panel and dust cover as described in Step 1 above.
   b. Remove one heat-sink mounting screw.
   c. Remove one transformer mounting-block screw from bottom of board.
   d. Remove the two screws, lock washers, and hex-nuts holding two wafers of FREQ HZ switch to bracket assembly.
   e. Remove four bracket-assembly retaining screws.

f. Carefully pull bracket assembly to rear to obtain work room. Enough slack is available in the wiring for all normal operations.

3. To remove the front panel, proceed as follows:
   a. Remove rear panel and dust cover as described in Step 1 above.
   b. Remove all knobs.
   c. Unsolder BNC connections.
   d. Tag and unsolder frequency-dial potentiometer leads.
   e. Pull light bulb from indicator lens.
   f. Remove four front-panel retaining screws.
   g. Carefully pull off front panel with frequency dial/potentiometer still attached.

**Power Supply Regulation**

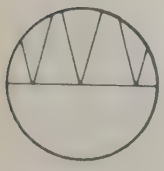
1. Connect voltmeter between TP1 (common) and TP2 (+) on Main Board. Adjust R104 for +15 Vdc ±100 mV.
2. Connect voltmeter between TP1 (common) and TP3 (−). Since the negative supply is referenced to the +15-volt supply, the voltmeter should indicate −15 Vdc ±100 mV.

**Square Wave Amplitude Symmetry**

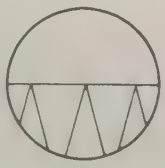
1. Set function selector to ⊓⊔ .
2. Connect oscilloscope with 1A5 plug-in to coaxial-wire lug on function switch.
3. Adjust R121 until square-wave negative peak is equal in amplitude to positive peak ±5 mV.

**Triangle Amplitude**

1. Set frequency dial for 2.0 (X1K range) and function selector to ∧∨ .
2. Connect oscilloscope, with 1A5 plug-in, to red wire lug on function switch.
3. Adjust R56 on main board for positive peak at +1.25 volts ±5 mV (see sketch).



Negative Peak



Positive Peak

4. Adjust R59 for negative peak at −1.25 volts ±5 mV.

**Output Amplifier** √

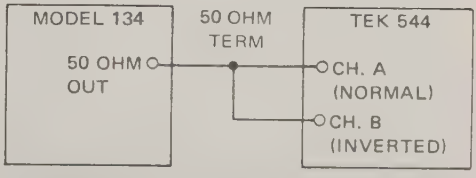
1. Connect oscilloscope to 50Ω OUT connector with 50-ohm terminator ( ⊓⊔ function).
2. Set FREQ HZ selector for X1K (VERNIER full cw) and frequency dial at 2.0.
3. Turn 20 V P-P MAX control fully ccw.
4. Adjust R150 for amplitude symmetry about ground.
5. Set FREQ HZ selector for X1M (2.0 dial setting).
6. Turn 20 V P-P MAX control fully cw.
7. Adjust C64 for best square-wave response without peaking.

**First VCG Null** √

1. Connect oscilloscope to 50Ω OUT connector.
2. Set FREQ HZ selector to X1K. Set dial at 1/100 of full scale (.02).
3. Short and open VCG IN to signal ground (outside of BNC connector) while monitoring output frequency variation. Adjust R11 for minimum frequency change.

**Time Symmetry** √

1. Connect unit and oscilloscope, with 1A1 plug-in set for alternate display, as shown in Figure 4-1.
2. Set FREQ HZ selector for X100K with VERNIER in full cw position ( ⊓⊔ function).
3. Set frequency dial for 2 kHz on oscilloscope (1/100 dial full scale).
4. Adjust R28 for time symmetry at 100:1 frequency ratio.




Trigger: Internal
Display: Alternate
Time Base; 50 microseconds/cm for 1/100 of 200 kHz
500 microseconds/cm for 1/1000 of 200 kHz

Figure 4-1.
Time Symmetry Measurement for Test Setup

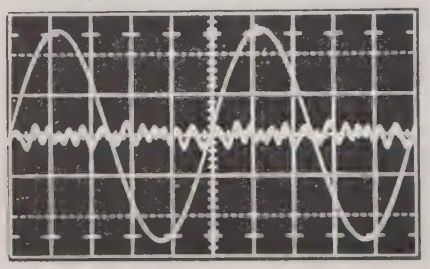
5. Turn VERNIER fully ccw and adjust R22 for bottom-of-dial time symmetry.
6. Repeat Steps 4 and 5, as necessary, for optimum symmetry.
7. Check for waveform time symmetry at the .2 and 2 frequency-dial settings.
8. Check for 1000:1 frequency ratio @ X100K, dial full cw, vernier full ccw.
9. If necessary, adjust R8 for slightly >1000:1 ratio.

**Frequency Calibration**

1. Connect counter to 50Ω OUT connector with 50Ω terminator.
2. Set FREQ HZ selector to X10K and VERNIER fully cw.
3. Align 2.0 dial mark with the dial indicator index and alternately switch from X10K to X1K range while adjusting R4 for a balanced error between the two positions.
4. Set FREQ HZ selector to X100K and dial at 2.0.
5. Adjust C16 to obtain 200.0 kHz on counter display.
6. Set FREQ HZ selector to X1M. Adjust C12 to obtain 2.00 MHz on counter display.
7. Dial alignment — No alignment is necessary if the dial is the push-on type. If it has a set screw, consult the dial alignment procedure at the end of this section.

**Sine, Distortion, Amplitude, and Balance √**

1. Set FREQ HZ selector for X1K (VERNIER full cw), function selector to ∿ and frequency dial at 2.0.
2. Connect oscilloscope, with 1A5 plug-in, to orange wire on function switch.
3. Adjust R133 to obtain 2.5 V p-p ±25 mV output.
4. Adjust R128 to balance output.
5. Connect the unit, distortion analyzer, and oscilloscope as shown in Figure 4-2.
6. Adjust R126 and R127 for minimum sine distortion (see photo).



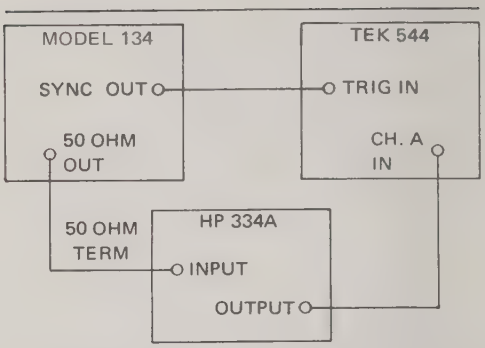



**Figure 4-2. Distortion Analysis Test Set-up.**

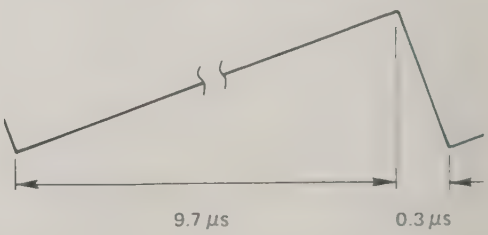
7. Set FREQ HZ selector by X10K.
8. Repeat Step 6 to obtain least distortion at both X1K and X10K ranges.
9. Repeat Steps 2, 3, and 4.
10. Connect spectrum analyzer and check sine distortion at 2 MHz.

**Sweep Amplitude √**

1. Main generator: frequency Hz sweep @ X10K, dial @ extreme cw position, vernier cw.
2. Connect oscilloscope, with 1A5 plug-in, to SWEEP OUT connector, unterminated.
3. Set SWEEP TIME for 10 mS/1 mS fully cw, sweep width off, variable cw.
4. Adjust R54 for 0 volts ±25 mV.
5. Adjust R63 for +5 volts ±25 mV.

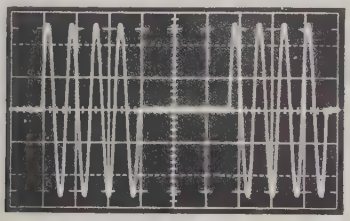
**Sweep Time √**

1. Connect oscilloscope to SWEEP OUT connector.
2. Set SWEEP TIME selector for 100 μS/10 μS with VARIABLE fully cw.
3. Adjust C19 on Sweep Board to obtain approximately 10 microsecond sawtooth duration (see sketch).



**Trigger/Gated Output** ✓

1. Connect oscilloscope to 50Ω OUT connector. Set FREQ HZ selector to X10K and FREQ dial for 2.0.
2. Set MODE selector for TONE BURST (SWEEP TIME 10 mS/1 mS.
3. Adjust TRIG LEVEL for appropriate tone-burst pattern.
4. Adjust R50 on main board until baseline is 0 volts ±50 mV (see photo).



## TROUBLESHOOTING

### Basic Techniques

Troubleshooting the Model 134 requires no special techniques. Listed below are a few reminders of basic electronics fault isolation.

1. Check control settings carefully. Many times an incorrect control setting, or a knob that has loosened on its shaft, will cause a false indication of a malfunction.
2. Check associated equipment connections. Make sure that all connections are properly connected to the correct connector.
3. Perform the checkout procedure. Many out-of-specification indications can be corrected by performing specific calibration procedures.
4. Visually check the interior of the instrument. Look for such indications as broken wires, charred components, loose leads, etc.

### Troubleshooting Chart

Table 4-2 provides a list of possible malfunction symptoms, probable causes, prescribed remedies, test points at which measurements are made, and parameter tolerances at these points. To use the troubleshooting chart, locate the symptom listed in Column 1 and follow the corresponding precedures. Localize the fault to a specific stage by checking the parameters given for the major test points. Next check the dc operating voltages at the pins of solid-state devices. Check associated passive elements with a high input impedance ohmmeter (power off) before replacing a suspected semiconductor element.

**Table 4-2. TROUBLESHOOTING CHART**

| Symptom | Probable Cause | Corrective Procedures |
|---|---|---|
| No outputs at 50Ω OUT connector | Blown fuse | Replace F1<br>a. 1/4A—115 Vac<br>b. 1/8A—230 Vac |
| | Power supply | Check TP1/TP2 for +15 V; TP1/TP3 for −15 V; TP1/TP5 for +6 V; TP1/TP6 for −6 V. Troubleshoot associated regulator. |
| | Output amplifier | Check at wiper (grn/wht wire) of function selector switch for waveform as selected by position of switch.<br>a. If waveform is present, troubleshoot output amplifier.<br>b. If no waveforms are present refer to **Main Generator Troubleshooting Hints.** |
| No sine wave output | Sine amplifier | Check for 260 mV p-p sine wave at pin 4 of IC8.<br>a. If present, check IC8 circuit.<br>b. If *not* present, check A1 circuit.<br>*NOTE:* Triangle wave must be present at pin 2 of A1 to obtain sinewave output. |

Table 4-2. TROUBLESHOOTING CHART Continued

| Symptom | Probable Cause | Corrective Procedures |
|---|---|---|
| No triangle, sine, or square wave | Generator loop | Refer to **Main Generator Troubleshooting Hints.** |
| All waveforms low in amplitude | Power amplifier | a. Check front-panel amplitude control.<br>b. Perform balance adjustment for power amplifier. |
| | Power supply | Check for proper voltages. |
| Frequency out of tolerance | Power supply | Check for proper power supply voltages as stated above. |
| | Maladjustment | Perform calibration procedure. |
| Sine wave not in spec | Maladjustment | Perform **Sine Distortion, Amplitude,** and **Balance** adjustment. |
| | Sine converter | Check for 260 mV p-p sine wave at pin 4 of IC8.<br>a. If normal, check sine amplifier IC8.<br>b. If abnormal, check A1 circuit. |
| Time symmetry of waveforms not correct. | Maladjustment | Perform **Time Symmetry** and frequency adjustments. |
| Triggered, gated, tone burst, and triggered sweep modes inoperative; continuous sweep normal. | Trigger comparator fault | Check at R32/R33 junction (sweep board) for +5 V with trigger level control fully cw. If abnormal, check Q1-Q4 on sweep board. |
| Triggered, gated, and tone burst modes inoperative; triggered sweep and continuous normal | Trigger/gate controller fault or trigger circuit failure. | Check Q5/Q6 on sweep board and Q3-Q5 on main board. |
| Sawtooth sweep not in spec | Maladjustment | Perform **Sweep Amplitude** and **Sweep Time** adjustments. |

**Main Generator Troubleshooting Hints**

The interactive nature of a closed loop presents a somewhat special problem when approached from a troubleshooting standpoint. The simplest way to reduce problem complexity is to open the loop, thereby removing the interaction. The basic units of the loop can then be tested individually. The following step-by-step procedure describes how this is done. (The generator loop is all contained on the main board).

1. Set instrument controls for 10 V p-p, 2 kHz sine-wave output.
2. Check at coaxial-wire lug of function selector switch for a 2.5 V p-p square wave. If normal, check output amplifier (Q34-Q40).
3. Unsolder and lift the end of R51 (TP7). This is the output of the integrator and input to the hysteresis switch. The generator loop has now been opened.
4. Inject a 2.5 V p-p triangle waveform into the hysteresis switch input lead (TP7).
5. Check at the coaxial-wire lug of the function selector switch for a 2.5 V p-p square wave at the injected frequency.

a. If present, hysteresis and output switches are okay. Proceed to Step 6.
b. If abnormal, check Q6-Q16 stages.

6. Vary frequency dial from ccw to cw while observing TP11 with a scope. Voltage at this point should remain at 0 volts throughout dial rotation. If a voltage variation is observed, check IC1 stage.
7. Vary frequency dial from ccw to cw while observing TP4. Voltage reading should vary from 0 to approximately −6 volts. If voltage does not vary, check IC2 stage and IC1 stage.
8. Vary frequency dial from ccw to cw while observing TP9. Voltage reading should remain at 0 volts. If voltage varies check IC3 stage.
9. Vary frequency dial from ccw to cw while observing TP10. Voltage should vary from 0 volts to approximately +6 volts. If voltage does not vary, check IC2 stage and IC3 stage.
10. Vary frequency dial from ccw to cw while observing TP8. Voltage reading should remain at 0 volts. If voltage varies, check IC4 and IC5 stages.
11. Re-install R51 and remove Q3 to isolate trigger circuit from integrator. If generator works properly, check Q3-Q5 stages. If abnormal, check Q1 and Q2 stages.

**Sweep Generator Troubleshooting Hints**

To check the sweep generator including the trigger sweep switching circuit, use the following procedure.

1. Set instrument controls as follows:
   a. SWEEP TIME for 100 S.
   b. SWEEP WIDTH for 2.
   c. MODE at TRIG SWP.
   d. TRIG LEVEL fully ccw.
   e. Frequency dial at 0.1 mark.

2. Check transistor junctions given in the following chart for indicated states with the sweep generator in the standby condition prior to the application of a sweep trigger. If all stages are normal, either IC2 or IC3 is faulty. If an abnormal "switch state" is encountered, check *all* junctions of the transistor before deciding that is the defective stage.

**Standby Condition**

| Stage | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13A | Q13B |
|---|---|---|---|---|---|---|---|---|
| State | OFF | ON | OFF | ON | ON | OFF | ON | OFF |

In some cases, it will be helpful to turn the TRIG LEVEL control quickly from fully ccw to fully cw and back to ccw, while checking transistor junctions. The following chart lists the sweep generator states immediately after triggering.

**Transition Condition (Extremely Fast)**

| Stage | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13A | Q13B |
|---|---|---|---|---|---|---|---|---|
| State | OFF | ON | OFF | OFF | OFF | ON | OFF | ON |

**Positive Slope Condition (Approximately 97 Seconds)**

| Stage | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13A | Q13B |
|---|---|---|---|---|---|---|---|---|
| State | OFF | OFF | ON | OFF | OFF | OFF | OFF | ON |

**Negative Slope Condition (Approximately 3 Seconds)**

| Stage | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13A | Q13B |
|---|---|---|---|---|---|---|---|---|
| State | ON | OFF | OFF | ON | OFF | OFF | ON | OFF |

**REPLACEMENT OF SWITCH WAFERS AND POTENTIOMETERS**

1. To replace FREQ HZ switch wafer C or D or the VERNIER potentiometer, proceed as follows:
   a. Remove rear panel and dust cover as previously described.
   b. Separate bracket assembly from chassis as previously described.
   c. Tag and unsolder leads to part being replaced.
   d. Pull defective part off shaft and repair or replace with recommended replacement part.
2. To replace FREQ HZ switch wafer A or B, proceed as follows:
   a. Remove rear panel and dust cover as previously described.
   b. Remove front panel as previously described.
   c. Tag and unsolder wires to switch wafers A and B.
   d. Unsolder wafer B PC-tabs from printed circuit board.
   e. Lift switch shaft slightly to free PC-tabs, rotate switch shaft so wafers clear board parts, and pull shaft end free of rear-mounted wafers C and D.
   f. Repair or replace defective part.
3. To repair or replace function selector wafers or 20 V P-P MAX potentiometer, proceed as follows:
   a. Remove rear panel and dust cover as previously described.
   b. Loosen set screws holding potentiometer and switch knobs to inner and outer shafts and remove knobs.

c. Tag and unsolder wires to defective part.
d. Unsolder potentiometer PC-tabs, lift shaft slightly to free tabs, rotate switch shaft so wafers clear board parts, and pull switch/potentiometer assembly out of front panel hole.
e. Repair or replace defective part.

## REPLACEMENT OF SINE CONVERTER

1. Remove rear panel and dust cover as previously described.
2. Unsolder the five pins of sine converter A1 from top of the printed circuit board, using a solder syringe.
3. Lift assembly from bottom of the board; a thin pencil-type soldering iron can be used, if necessary, to apply temporary heat during removal.

## FREQUENCY DIAL ALIGNMENT PROCEDURE

If the generator has a frequency dial secured to the main shaft by a set screw, the following procedure should be followed to align the dial:

1. Connect counter to 50Ω OUT connector with a 50Ω terminator.
2. Set FREQ HZ selector to X10K and VERNIER fully cw.
3. Set frequency dial potentiometer for 2 kHz on the counter display.
4. Align 0.2 dial mark with the dial indicator index and tighten set screw.
5. Align 2.0 dial mark with the dial indicator index and adjust R4 to obtain maximum dial accuracy on bottom four ranges.
6. Set FREQ HZ selector to X100K and dial fully cw.
7. Turn frequency VERNIER fully ccw.
8. Adjust R8 for 150 ±20 Hz on counter.
9. Check that generator continues to oscillate over the full range of the frequency VERNIER dial. If not, readjust R8.
10. Turn VERNIER fully cw (CAL) and set frequency dial to align 2.0 with index mark.
11. Adjust C16 to obtain 200.0 kHz on counter display.
12. Set FREQ HZ selector to X1M. Adjust C12 to obtain 2.00 MHz on counter display.

# SECTION 5
# DATA PACKAGE

## INTRODUCTION

This section contains data packages for the Model 134. Each data package is a quick-access document, containing maintenance data arranged for convenient viewing of the schematic diagram and all supporting data. Each data package includes a parts-location illustration; a replaceable parts list; voltage/waveform data; and a schematic diagram. Voltage and waveform data are provided on the diagrams at indicated test points as an aid to troubleshooting. Also, a list of manufacturers is included in this section.

## LIST OF MANUFACTURERS

American Radionics . . . American Radionics, Inc.
Danbury, Connecticut

Amp . . . . . Amp, Inc.
Harrisburg, Pennsylvania

ARCO. . . . . Arco Electronics
Great Neck, L.I., New York

Boots . . . . . Boots-Townsend Aircraft
Santa Ana, California

Corn . . . . . Corning Glass Works
Bradford, Pennsylvania

CRL . . . . . Centralab
Division of Globe-Union
Milwaukee, Wisconsin

CTS . . . . . Chicago Telephone Systems
Los Angeles, California

Electro . . . . . Electro Cube, Inc.
San Gabriel, California

Elco . . . . . Elco Corp.
Willow Grove, Pennsylvania

Elpac . . . . . Elpac Incorporated
Fullerton, California

Erie . . . . . Erie Technological Products Inc.
Erie, Pennsylvania

Fair . . . Fairchild Semiconductor Corporation
Palo Alto, California

IBM . . . . . IBM Industrial Products
White Plains, New York

IMB . . . . . IMB Electronics Products
Santa Fe Springs, California

IRC . . . . . IRC Inc.
Philadelphia, Pennsylvania

Kings . . . . . Kings Electronic Co., Inc.
Tickahoe, New York

Littelfuse . . . . . Littelfuse Inc.
Des Plaines, Illinois

Motorola . . . Motorola Semiconductor Products
Phoenix, Arizona

Mura . . . . . Mura Corp.
Great Neck, L.I., New York

RCA . . . . . RCA Semiconductor Division
Somerville, New Jersey

Richey . . . . . Richey Electronics
Nashville, Tennessee

Semtech . . . . . Semtech Corporation
Newbury Park, California

HHSmith . . . . . Herman H. Smith, Inc.
Brooklyn, New York

Sprague . . . . . Sprague Electric Company
North Adams, Massachusetts

Stack . . . . . Stackpole Carbon Company
St. Marys, Pennsylvania

Switchcraft . . . . . Switchcraft, Inc.
Chicago, Illinois

TI . . . . . Texas Instruments, Inc.
Dallas, Texas

USECO . . . . . USECO Inc.
Mt. Vernon, New York

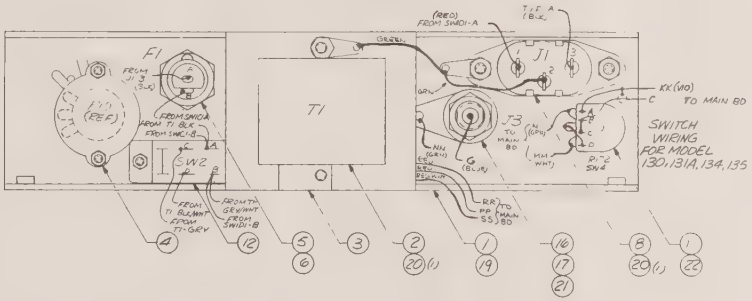
Wakefield . . . . . Wakefield Engineering, Inc.
Wakefield, Massachusetts

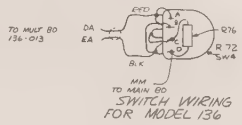
Wavetek . . . . . Wavetek
San Diego, California

# NOTES

# NOTES

# NOTES




## PARTS LIST

| ITEM | REF DES | DESCRIPTION | MFGR | MFGR NO | QTY | |
|---|---|---|---|---|---|---|
| 1 | | BRACKET | WAVETEK | B130-302F | 1 | |
| 2 | T1 | TRANSFORMER | | C130-500 | 1 | |
| 3 | | TRANSFORMER BRACKET | | A130-306 | 1 | |
| 4 | | STANDOFF (MODEL 130 ONLY) | HH SMITH | 2342 | 2 | |
| 5 | F1 | FUSE 1/4 AMP | LITTELFUSE | 313 250 | 1 | FOR 115V MODEL |
| 6 | | FUSE HOLDER | | 342012 | 1 | |
| 7 | | FUSE 1/8 AMP 230V | | 313.125 | 1 | FOR 230V MODEL |
| 8 | J1 | POWER RECEPTACLE | SWITCHCRAFT | EAC3-6 | 1 | |
| 9 | R76 | RESISTOR 150Ω 2% CARBON 2W | STACKPOLE | RC06F151GX | 1 | MODEL 136 ONLY |
| 10 | | | | | | |
| 11 | R172 SW4 | DC OFFSET SWITCH 10K/1MΩ | A-B | 70K3GG3E1N4B | 1 | |
| 12 | SW2 | 115 230V SWITCH | SWITCHCRAFT | 46206LF (OR EQUIVALENT) | 1 | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | J3 | BNC CONNECTOR | KING | KC7946 | 1 | |
| 17 | | SHOULDER WASHER | SMITH | 2668 | 2 | |
| 18 | | | | | | |
| 19 | | FASTENERS 4-32 | SOUTHCO | 74-11-106-13 | 8 | |
| 20 | | SOLDER LUG | H H SMITH | 1414-4 | 2 | |
| 21 | | SOLDER LUG | | 1497 | 1 | |
| 22 | | KNOB | ELMA | 020-222 | 1 | |
| 23 | | MICA INSULATOR | WAVETEK | A140-307A | 1 | |
| 24 | | | | | | |
| 25 | | | | | | |

| | | | | |
|---|---|---|---|---|
| E | ECN 601 | | | |
| D | JI WAS AC8 Q | | | |
| C | ECN 341 | MS | | |
| B | ECO 29 | MS | | |
| A | ECN 283 | | | |
| | | BY | DATE | APP'D |

WAVETEK

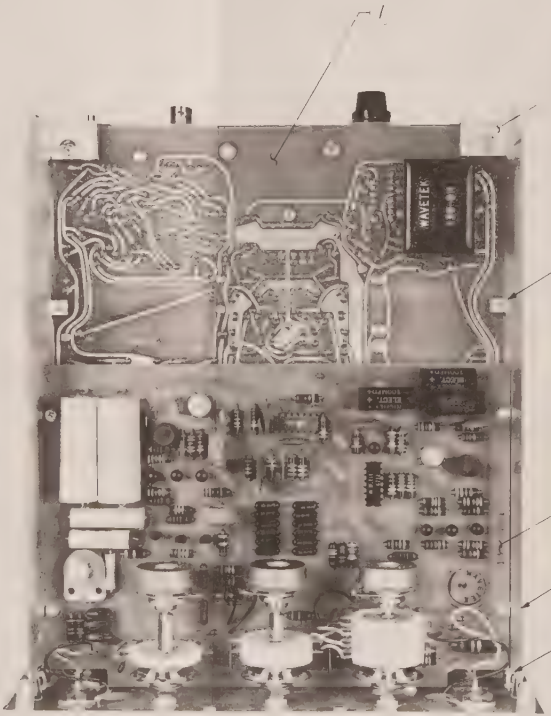
DRAWN: N.A. DATE: 7-21-69 APP'D:

N.A

ASSY, BRACKET

SIZE: N/A DWG NO: L130 CON REV: E

THIS DRAWING AND SPECIFICATION, WHETHER SUCH OR PART OF IT IS DISCLOSED BY THE RECIPIENT OR NOT, SHALL NOT BE REPRODUCED FOR ANY REASON EXCEPT CONSTRUCTION, OPERATION AND MAINTENANCE WITHOUT WRITTEN AUTHORIZATION.



*INDICATES ITEMS NOT SHOWN

PARTS LIST

| ITEM | REF DES | DESCRIPTION | MFGR | MFGR PART NO. | QTY |
|---|---|---|---|---|---|
| 1 | | MAINBOARD ASSY | WAVETEK | | 1-24 |
| 2 | | SWEEP BOARD ASSY | | | 1 |
| 3 | | CASTING | | | 1 |
| 4 | | COVER | | | 1 |
| 5 | | REAR PANEL | | | 1 |
| 6 | | SIDE PLATE | | | 2 |
| 7 | | MOUNTING BLOCK | | | 2 |
| 8 | | BAIL KIT | | | 2 |
| 9 | | DIAL KNOB | | | 1 |
| 10 | | CO-AXIAL KNOB | | | 5 |
| 11 | | | | | |
| 12 | | SMALL KNOB | | | 5 |
| 13 | | FRONT PANEL (134) | | | 1 |
| 14 | | DIAL | | | 1 |
| 15 | | INDICATOR LENS | | | 1 |
| 16 | | RETAINER | | | 1 |
| 17 | | FASTENER | | | 2 |
| 18 | R175 | POT, MODIFIED | WAVETEK | | 1 |
| 19 | J2,4,5,6 | BNC CONNECTOR | KING | | 4 |
| 20 | | POWER CORD | BELDEN | 7255 | 1 |
| 21 | | FAST | | | 6 |
| 22 | | | | | |
| 23 | | CAPTIVE SCREW | DEUTSCH | 7400-0-8-2 | 2 |
| 24 | | CHASSIS FASTENER | USECO | 19418 | 8 |
| 25 | | CLIP NUT | | | 4 |
| 26 | | BUSHING | THOMPSON | 4L2EF | 5 |
| 27 | | SHOULDER WASHER | SMITH | 2668 | 8 |
| 28 | | SOLDER LUG | SMITH | 1447 | 4 |
| 29 | | | | | |
| 30 | | | | | |
| 31 | | CASTING MODIFICATION | WAVETEK | | 1 |
| 32 | | | | | |

WAVETEK

material: N/A

finish: N/A

title: CHASSIS ASSY

model no. 130-134

dwg no. 0034-000

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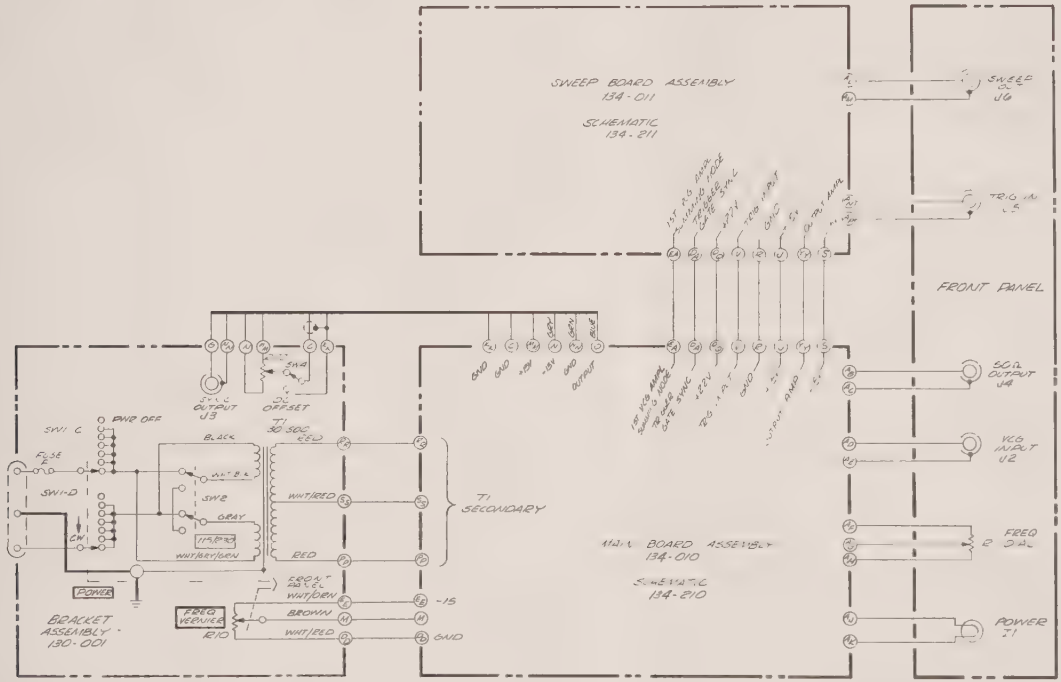


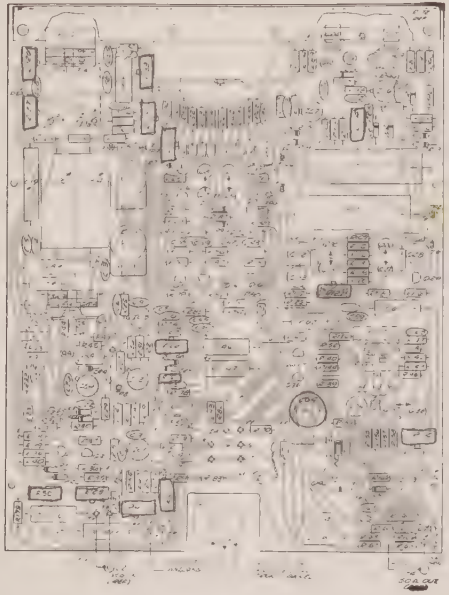

NOTES UNLESS OTHERWISE SPECIFIED
1. LETTER DESIGNATIONS ARE INTERCONNECTION POINTS

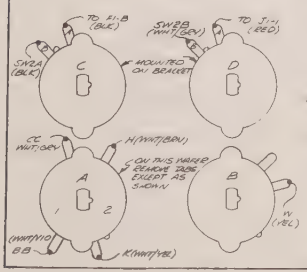
| | | | | | |
|---|---|---|---|---|---|
| A | ECN 341 | | | | |
| rev | ecn | by | date | app | |

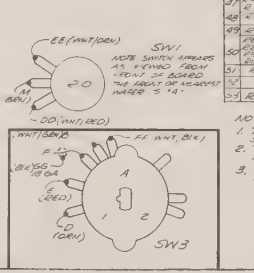
WAVETEK

SCHEMATIC
CHASSIS

SIZE D | 34,200 | REV A






## PARTS LIST

| Ref Des | Description | MFGR | MFGR No | Qty |
|---|---|---|---|---|
| | CAPACITORS | | | |
| C1 | 2 | SILVAMICA 500 V 5% | ARCO | CM15 E 200 J | 1 |
| C2 | | | | 680pf | | 680J | 1 |
| C3 | | | | 68pf | | | |
| C4 | C68,C39 | | | 150pf | | 5 % | 2 |
| C5 | C49, C32 | | | 300pf | | 2 % | 2 |
| C6 | C30, C31 | | | 180pf | | 5 % | 2 |
| C7 | C5 | | | 75pf | | 2 % | 1 |
| C8 | C9, C22 | CERAMIC DISC, ROCH | 10pf | CRL | 3D 00 J | 2 |
| C9 | C23, C28 | | | 220pf | | 10% | 4 |
| C10 | C31 | | | 470pf | | | |
| C11 | C29, C43 | | | 3300pf | | -330 | 2 |
| C12 | C42, C53 | | | 4700pf | | -470 | 2 |
| C13 | C47, C48 | | | .01 | | -01 | 3 |
| C14 | C51, C54 | | | .033uf | | -033 | 2 |
| C15 | C50, C51 | | | .22uf | | -221 | 4 |
| C16 | C3 | | | .33uf | | -331 | 1 |
| C17 | C20, C21 | | | .047uf | | -473 | 2 |
| C18 | C24, C33 | | 50V. .005uf | | CK-502 | 4 |
| C19 | C25, C26 | | .01uf | | CE-103 | 2 |
| C20 | C27, C34 | | 20V. 1uf | | UCE20-105 | 16 |
| C21 | C35, C36 | | | | | |
| C22 | C | | 20V. 100% 10% | ELEC | WHITEER | 30-501-G | 1 |
| C23 | C18 | | .1uf | | | | 1 |
| C24 | C19 | | 47VAR 200V | | | | 1 |
| C25 | C44 | | M | 10% 5% | | | 2 |
| C26 | C52, C37, C41, C42 | ELECTROLYTIC | 450 uf | SPRAGUE | 39D107G450HA4 | 1 |
| C27 | C45, C46 | | 35V. 100uf | SPRAGUE | 19D106G035HA4 | 1 |
| C28 | C7, C8, C40 | VARIABLE | 4.5-25pf | ERIE | 503-001-312 | 3 |
| C29 | | | | | | |
| C30 | | | | | | |
| C31 | CR1 thru CR10 | DIODES | HD6666 | FAIRCHILD | FD6666 | 15 |
| C32 | CR11 thru CR22 | | | SCE-1 | SENTERN | SCE-1 | 4 |
| C33 | CR23, CR24 | | | | WHITEER | 150 506 | 3 |
| C34 | | | | | | | |
| C35 | | | | | | | |
| C36 | | | | | | | |
| C37 | | | | | | | |
| C38 | | | | | | | |
| C39 | | | | | | | |
| C40 | IC1, IC2 | INTEGRATED CIRCUITS LINEAR | | | FAIRCHILD | ULA709C | 2 |
| C41 | IC3, IC7 | | | (-13) | | | 2 |
| C42 | IC4, IC5 | | | (-14) | | | 2 |
| C43 | IC6 | | | (-15) | | RCA | CA3030 | 1 |
| C44 | IC9 | | | (-17) | | | CA3020 | 1 |
| C45 | IC12 | | | (-18) | | | CA3039 | 1 |
| C46 | IC8 | | | (-16) | | | CA3030 | 1 |
| C47 | | | | | | | | |
| C48 | | | | | | | | |
| C49 | | | | | | | | |
| C50 | R58, R59 | POTENTIOMETER | | 100 Ω | | CRL | BA1103-301 | 2 |
| C51 | R26, R27 | | | 250 Ω | | | -021 | 2 |
| C52 | R28, R29 | | | 500 Ω | | | -802 | 3 |
| C53 | R30, R31 | | | 1K | | CTS | 1K | 3M3 |
| C54 | R104 | | | 1K | | CRL | BA1103-302 | 1 |
| C55 | R101, R102, R103, R105 | | | 100K | | | -813 | 7 |
| C56 | R100 | | | 10K | | CTS | 3D 10A | |
| C57 | R110 | | | | | | | |
| C58 | R136 | CARBON, 1/2W, 5% | | 1.8Ω | | STACKPOLE | RC20GF 289 J | 1 |

NOTES: UNLESS OTHERWISE SPECIFIED
1. T* INDICATES TERMINAL ON CIRCUIT SIDE
2. T INDICATES TERMINAL ON COMPONENT SIDE
3. # INDICATES SELECTED VALUE; NOMINAL VALUE AS SHOWN

## PARTS LIST

| Ref Des | Description | MFGR | MFGR No | Qty |
|---|---|---|---|---|
| | RESISTORS | | | |
| R1 | CARBON 2W, 5% | STACKPOLE | RC42GF | 2 |
| R2 | | | | |
| R3 | | | 6.81Ω | | | 2 |
| R4 | | | | | | |
| R5 | | | 10Ω | | | 2 |
| R6 | | | 33Ω | | | 1 |
| R7 | | | | | | |
| R8 | | | 47Ω | | | 5 |
| R9 | | | | | | |
| R10 | | | 68Ω | | | 4 |
| R11, R58, R70, R80 | | | 100Ω | | | 4 |
| R12, R57 | | | 10% | 390Ω | | 2 |
| R13, R77 | | | 5% | 390Ω | | 2 |
| R14, R43 | | | 5% | 470Ω | | 4 |
| R15, R40 | | | 5% | 560Ω | | 4 |
| R16, R38 | | | 5% | 680Ω | | 4 |
| R17, R34 | | | 5% | 750Ω | | 1 |
| R18 | | | 10% | 1K | | 2 |
| R19, R33, R60 | | | | | | |
| R20, R25, R78, R99 | | | | 1.5K | | 4 |
| R21, R39, R79 | | | | 2.2K | | 5 |
| R22, R82 | | | | | | |
| R23, R73, R74 | | | | 2.7K | | 4 |
| R24, R32, R62, R63, R64 | | | | 3.9K | | 5 |
| R26, R69, R81, R83 | | | | 4.7K | | 7 |
| R27, R61, R67, R68 | | | | | | |
| R28, R29 | | | | 5% | 6.2K | | 3 |
| R30, R31 | | | 10% | 6.8K | | 4 |
| R35, R36, R75, R76 | | | | 10K | | 4 |
| R37 | | | 5% | 13K | | 1 |
| R41, R42 | | | 5% | 15K | | 2 |
| R44, R54 | | | | 27K | | 3 |
| R45, R46 | | | | 51K | | 1 |
| R47, R48 | | | | 68K | | 1 |
| R49, R50 | | | | 100K | | 2 |
| R51, R52, R53 | # | | | 200K | | 3 |
| R55, R56 | | | | 300K | | 2 |
| R65, R66 | | | | 430K | | 2 |
| R71, R72 | | | | 620K | | 2 |
| R84, R85, R86 | | | | 820K | | 3 |
| R87, R88 | | | | 1.2M | | 2 |
| R89, R90 | | | | 1.5M | | 2 |
| R91, R92 | | | | 2.2M | | 2 |
| R93, R94 | | | | 3.3M | | 2 |
| R95, R96 | | | | 4.7M | | 2 |
| R97, R98 | | | | 6.8M | | 2 |
| R100 | | | | 10M | | 1 |
| R101 | | | 10% | 6.8MΩ | | 1 |
| R102, R103 | | | | 10M | | 2 |
| R104 | | | | 20M | | 1 |
| R105 | | | | 30M | | 1 |
| R106 | | | | 40M | | 1 |
| R107 | | | | 50M | | 1 |
| R108 | | | | 60M | | 1 |
| R109 | | | | 70M | | 1 |
| R110 | | | | 80M | | 1 |
| R111 | | | | 90M | | 1 |
| R112 | | | | 100M | | 1 |
| R113 | | | | 110M | | 1 |
| R114 | | | | 120M | | 1 |
| R115 | | | | 130M | | 1 |
| R116 | | | | 140M | | 1 |
| R117 | | | | 150M | | 1 |
| R118 | | | | 160M | | 1 |
| R119 | | | | 170M | | 1 |
| R120 | | | | 180M | | 1 |
| R121 | | | | 190M | | 1 |
| R122 | | | | 200M | | 1 |
| R123 | | | | 210M | | 1 |
| R124 | | | | 220M | | 1 |
| R125 | | | | 230M | | 1 |
| R126 | | | | 240M | | 1 |
| R127 | | | | 250M | | 1 |
| R128 | | | | 260M | | 1 |
| R129 | | | | 270M | | 1 |
| R130 | | | | 280M | | 1 |
| R131 | | | | 290M | | 1 |
| R132 | | | | 300M | | 1 |
| R133 | | | | 310M | | 1 |
| R134 | | | | 320M | | 1 |
| R135 | | | | 330M | | 1 |
| R136 | | | | 340M | | 1 |
| R137 | | | | 350M | | 1 |
| R138 | | | | 360M | | 1 |
| R139 | | | | 370M | | 1 |
| R140 | | | | 380M | | 1 |
| R141 | | | | 390M | | 1 |
| R142 | | | | 400M | | 1 |
| R143 | | | | 410M | | 1 |
| R144 | | | | 420M | | 1 |
| R145 | | | | 430M | | 1 |
| R146 | | | | 440M | | 1 |
| R147 | | | | 450M | | 1 |
| R148 | | | | 460M | | 1 |
| R149 | | | | 470M | | 1 |
| R150 | | | | 480M | | 1 |
| R151 | | | | 490M | | 1 |
| R152 | | | | 500M | | 1 |
| R153 | | | | 510M | | 1 |
| R154 | | | | 520M | | 1 |
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| R162 | | | | 600M | | 1 |
| R163 | | | | 610M | | 1 |
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| R168 | | | | 660M | | 1 |
| R169 | | | | 670M | | 1 |
| R170 | | | | 680M | | 1 |
| R171 | | | | 690M | | 1 |
| R172 | | | | 700M | | 1 |
| R173 | | | | 710M | | 1 |
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| R197 | | | | 950M | | 1 |
| R198 | | | | 960M | | 1 |
| R199 | | | | 970M | | 1 |
| R200 | | | | 980M | | 1 |
| R201 | | | | 990M | | 1 |
| R202 | | | | 1000M | | 1 |

| Ref Des | Description | MFGR | MFGR No | Qty |
|---|---|---|---|---|
| R1 | MEDIUM 1/4 W, 5% | ALLEN | CHG- | |
| R2 | | | 2.7K | | | |
| R3 | | | 6.8K | | | |
| R4 | | | 1W, 1% | ERIE | CHG- | |
| R5 | MATCHED RESISTOR | | | | | |
| R6 | MATCHED RESISTOR | | | | | |
| R7 | | | | | | |
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| Ref Des | Description | MFGR | MFGR No | Qty |
|---|---|---|---|---|
| C1 | 2 | SILVAMICA 500 V 5% | ARCO | CM15 E 200 J | 1 |
| C2 | | | | 680pf | | 680J | 1 |
| C3 | | | | 68pf | | | |
| C4 | C68,C39 | | | 150pf | | 5 % | 2 |
| C5 | C49, C32 | | | 300pf | | 2 % | 2 |
| C6 | C30, C31 | | | 180pf | | 5 % | 2 |
| C7 | C5 | | | 75pf | | 2 % | 1 |
| C8 | C9, C22 | CERAMIC DISC, ROCH | 10pf | CRL | 3D 00 J | 2 |
| C9 | C23, C28 | | | 220pf | | 10% | 4 |
| C10 | C31 | | | 470pf | | | |
| C11 | C29, C43 | | | 3300pf | | -330 | 2 |
| C12 | C42, C53 | | | 4700pf | | -470 | 2 |
| C13 | C47, C48 | | | .01 | | -01 | 3 |
| C14 | C51, C54 | | | .033uf | | -033 | 2 |
| C15 | C50, C51 | | | .22uf | | -221 | 4 |
| C16 | C3 | | | .33uf | | -331 | 1 |
| C17 | C20, C21 | | | .047uf | | -473 | 2 |
| C18 | C24, C33 | | 50V. .005uf | | CK-502 | 4 |
| C19 | C25, C26 | | .01uf | | CE-103 | 2 |
| C20 | C27, C34 | | 20V. 1uf | | UCE20-105 | 16 |
| C21 | C35, C36 | | | | | |
| C22 | C | | 20V. 100% 10% | ELEC | WHITEER | 30-501-G | 1 |
| C23 | C18 | | .1uf | | | | 1 |
| C24 | C19 | | 47VAR 200V | | | | 1 |
| C25 | C44 | | M | 10% 5% | | | 2 |
| C26 | C52, C37, C41, C42 | ELECTROLYTIC | 450 uf | SPRAGUE | 39D107G450HA4 | 1 |
| C27 | C45, C46 | | 35V. 100uf | SPRAGUE | 19D106G035HA4 | 1 |
| C28 | C7, C8, C40 | VARIABLE | 4.5-25pf | ERIE | 503-001-312 | 3 |
| C29 | | | | | | |
| C30 | | | | | | |
| C31 | CR1 thru CR10 | DIODES | HD6666 | FAIRCHILD | FD6666 | 15 |
| C32 | CR11 thru CR22 | | | SCE-1 | SENTERN | SCE-1 | 4 |
| C33 | CR23, CR24 | | | | WHITEER | 150 506 | 3 |
| C34 | | | | | | | |
| C35 | | | | | | | |
| C36 | | | | | | | |
| C37 | | | | | | | |
| C38 | | | | | | | |
| C39 | | | | | | | |
| C40 | IC1, IC2 | INTEGRATED CIRCUITS LINEAR | | | FAIRCHILD | ULA709C | 2 |
| C41 | IC3, IC7 | | | (-13) | | | 2 |
| C42 | IC4, IC5 | | | (-14) | | | 2 |
| C43 | IC6 | | | (-15) | | RCA | CA3030 | 1 |
| C44 | IC9 | | | (-17) | | | CA3020 | 1 |
| C45 | IC12 | | | (-18) | | | CA3039 | 1 |
| C46 | IC8 | | | (-16) | | | CA3030 | 1 |
| C47 | | | | | | | | |
| C48 | | | | | | | | |
| C49 | | | | | | | | |
| C50 | R58, R59 | POTENTIOMETER | | 100 Ω | | CRL | BA1103-301 | 2 |
| C51 | R26, R27 | | | 250 Ω | | | -021 | 2 |
| C52 | R28, R29 | | | 500 Ω | | | -802 | 3 |
| C53 | R30, R31 | | | 1K | | CTS | 1K | 3M3 |
| C54 | R104 | | | 1K | | CRL | BA1103-302 | 1 |
| C55 | R101, R102, R103, R105 | | | 100K | | | -813 | 7 |
| C56 | R100 | | | 10K | | CTS | 3D 10A | |
| C57 | R110 | | | | | | | |
| C58 | R136 | CARBON, 1/2W, 5% | | 1.8Ω | | STACKPOLE | RC20GF 289 J | 1 |

| Ref Des | Description | MFGR | MFGR No | Qty |
|---|---|---|---|---|
| | RESISTORS | | | |
| R1 | CARBON 2W, 5% | STACKPOLE | RC42GF | 2 |
| R2 | | | | |
| R3 | | | 6.81Ω | | | 2 |
| R4 | | | | | | |
| R5 | | | 10Ω | | | 2 |
| R6 | | | 33Ω | | | 1 |
| R7 | | | | | | |
| R8 | | | 47Ω | | | 5 |
| R9 | | | | | | |
| R10 | | | 68Ω | | | 4 |
| R11, R58, R70, R80 | | | 100Ω | | | 4 |
| R12, R57 | | | 10% | 390Ω | | 2 |
| R13, R77 | | | 5% | 390Ω | | 2 |
| R14, R43 | | | 5% | 470Ω | | 4 |
| R15, R40 | | | 5% | 560Ω | | 4 |
| R16, R38 | | | 5% | 680Ω | | 4 |
| R17, R34 | | | 5% | 750Ω | | 1 |
| R18 | | | 10% | 1K | | 2 |
| R19, R33, R60 | | | | | | |
| R20, R25, R78, R99 | | | | 1.5K | | 4 |
| R21, R39, R79 | | | | 2.2K | | 5 |
| R22, R82 | | | | | | |
| R23, R73, R74 | | | | 2.7K | | 4 |
| R24, R32, R62, R63, R64 | | | | 3.9K | | 5 |
| R26, R69, R81, R83 | | | | 4.7K | | 7 |
| R27, R61, R67, R68 | | | | | | |
| R28, R29 | | | | 5% | 6.2K | | 3 |
| R30, R31 | | | 10% | 6.8K | | 4 |
| R35, R36, R75, R76 | | | | 10K | | 4 |
| R37 | | | 5% | 13K | | 1 |
| R41, R42 | | | 5% | 15K | | 2 |
| R44, R54 | | | | 27K | | 3 |
| R45, R46 | | | | 51K | | 1 |
| R47, R48 | | | | 68K | | 1 |
| R49, R50 | | | | 100K | | 2 |
| R51, R52, R53 | # | | | 200K | | 3 |
| R55, R56 | | | | 300K | | 2 |
| R65, R66 | | | | 430K | | 2 |
| R71, R72 | | | | 620K | | 2 |
| R84, R85, R86 | | | | 820K | | 3 |
| R87, R88 | | | | 1.2M | | 2 |
| R89, R90 | | | | 1.5M | | 2 |
| R91, R92 | | | | 2.2M | | 2 |
| R93, R94 | | | | 3.3M | | 2 |
| R95, R96 | | | | 4.7M | | 2 |
| R97, R98 | | | | 6.8M | | 2 |
| R100 | | | | 10M | | 1 |
| R101 | | | 10% | 6.8MΩ | | 1 |
| R102, R103 | | | | 10M | | 2 |
| R104 | | | | 20M | | 1 |
| R105 | | | | 30M | | 1 |
| R106 | | | | 40M | | 1 |
| R107 | | | | 50M | | 1 |
| R108 | | | | 60M | | 1 |
| R109 | | | | 70M | | 1 |
| R110 | | | | 80M | | 1 |
| R111 | | | | 90M | | 1 |
| R112 | | | | 100M | | 1 |
| R113 | | | | 110M | | 1 |
| R114 | | | | 120M | | 1 |
| R115 | | | | 130M | | 1 |
| R116 | | | | 140M | | 1 |
| R117 | | | | 150M | | 1 |
| R118 | | | | 160M | | 1 |
| R119 | | | | 170M | | 1 |
| R120 | | | | 180M | | 1 |
| R121 | | | | 190M | | 1 |
| R122 | | | | 200M | | 1 |
| R123 | | | | 210M | | 1 |
| R124 | | | | 220M | | 1 |
| R125 | | | | 230M | | 1 |
| R126 | | | | 240M | | 1 |
| R127 | | | | 250M | | 1 |
| R128 | | | | 260M | | 1 |
| R129 | | | | 270M | | 1 |
| R130 | | | | 280M | | 1 |
| R131 | | | | 290M | | 1 |
| R132 | | | | 300M | | 1 |
| R133 | | | | 310M | | 1 |
| R134 | | | | 320M | | 1 |
| R135 | | | | 330M | | 1 |
| R136 | | | | 340M | | 1 |
| R137 | | | | 350M | | 1 |
| R138 | | | | 360M | | 1 |
| R139 | | | | 370M | | 1 |
| R140 | | | | 380M | | 1 |
| R141 | | | | 390M | | 1 |
| R142 | | | | 400M | | 1 |
| R143 | | | | 410M | | 1 |
| R144 | | | | 420M | | 1 |
| R145 | | | | 430M | | 1 |
| R146 | | | | 440M | | 1 |
| R147 | | | | 450M | | 1 |
| R148 | | | | 460M | | 1 |
| R149 | | | | 470M | | 1 |
| R150 | | | | 480M | | 1 |
| R151 | | | | 490M | | 1 |
| R152 | | | | 500M | | 1 |
| R153 | | | | 510M | | 1 |
| R154 | | | | 520M | | 1 |
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| R161 | | | | 590M | | 1 |
| R162 | | | | 600M | | 1 |
| R163 | | | | 610M | | 1 |
| R164 | | | | 620M | | 1 |
| R165 | | | | 630M | | 1 |
| R166 | | | | 640M | | 1 |
| R167 | | | | 650M | | 1 |
| R168 | | | | 660M | | 1 |
| R169 | | | | 670M | | 1 |
| R170 | | | | 680M | | 1 |
| R171 | | | | 690M | | 1 |
| R172 | | | | 700M | | 1 |
| R173 | | | | 710M | | 1 |
| R174 | | | | 720M | | 1 |
| R175 | | | | 730M | | 1 |
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| R177 | | | | 750M | | 1 |
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| R182 | | | | 800M | | 1 |
| R183 | | | | 810M | | 1 |
| R184 | | | | 820M | | 1 |
| R185 | | | | 830M | | 1 |
| R186 | | | | 840M | | 1 |
| R187 | | | | 850M | | 1 |
| R188 | | | | 860M | | 1 |
| R189 | | | | 870M | | 1 |
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| R193 | | | | 910M | | 1 |
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| R197 | | | | 950M | | 1 |
| R198 | | | | 960M | | 1 |
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| R200 | | | | 980M | | 1 |
| R201 | | | | 990M | | 1 |
| R202 | | | | 1000M | | 1 |

| Ref Des | Description | MFGR | MFGR No | Qty |
|---|---|---|---|---|
| R1 | MEDIUM 1/4 W, 5% | ALLEN | CHG- | |
| R2 | | | 2.7K | | | |
| R3 | | | 6.8K | | | |
| R4 | | | 1W, 1% | ERIE | CHG- | |
| R5 | MATCHED RESISTOR | | | | | |
| R6 | MATCHED RESISTOR | | | | | |
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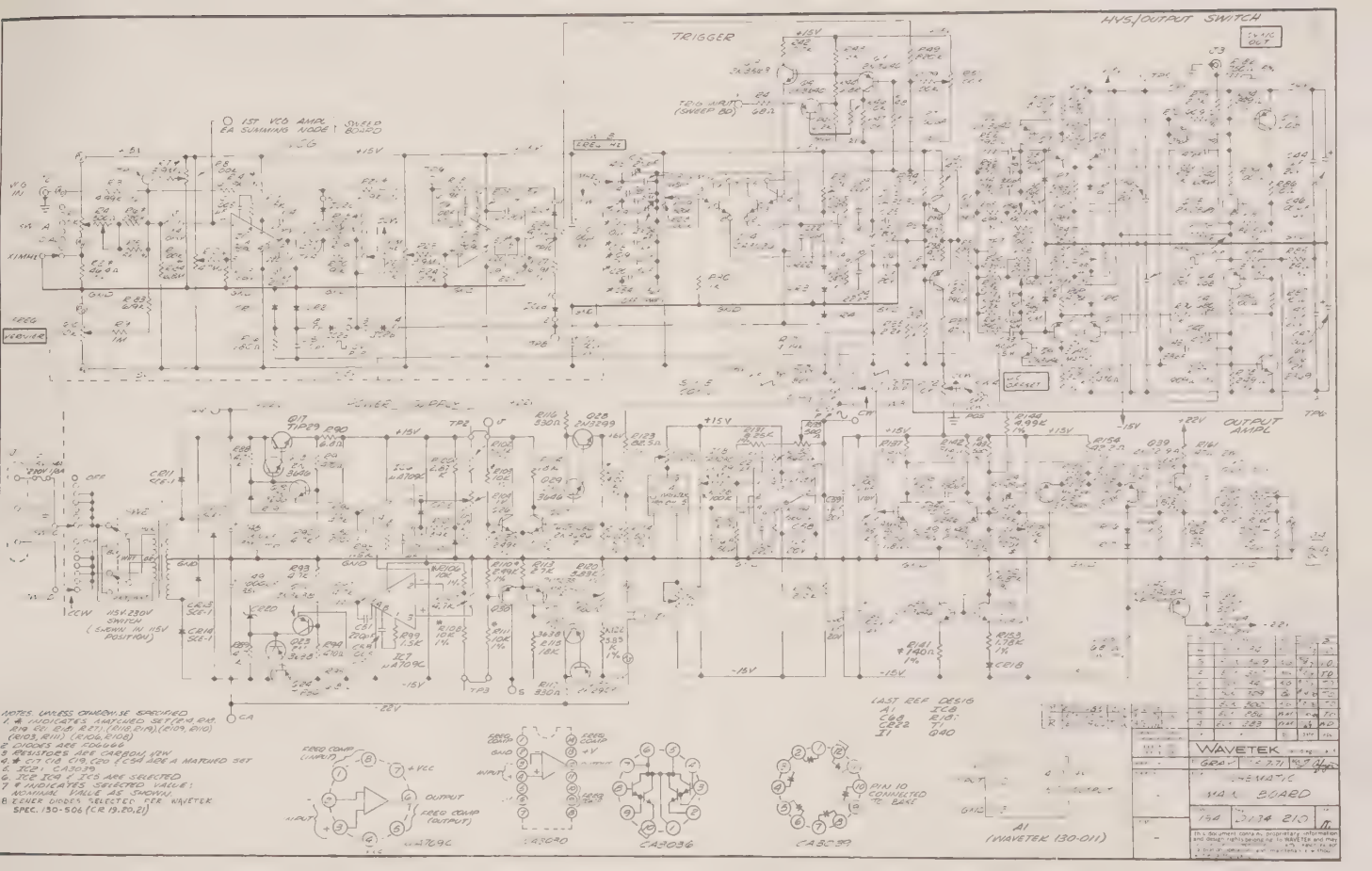
| Ref Des | Description | MFGR | MFGR No | Qty |
|---|---|---|---|---|
| C1 | 2 | SILVAMICA 500 V 5% | ARCO | CM15 E 200 J | 1 |
| C2 | | | | 680pf | | 680J | 1 |
| C3 | | | | 68pf | | | |
| C4 | C68,C39 | | | 150pf | | 5 % | 2 |
| C5 | C49, C32 | | | 300pf | | 2 % | 2 |
| C6 | C30, C31 | | | 180pf | | 5 % | 2 |
| C7 | C5 | | | 75pf | | 2 % | 1 |
| C8 | C9, C22 | CERAMIC DISC, ROCH | 10pf | CRL | 3D 00 J | 2 |
| C9 | C23, C28 | | | 220pf | | 10% | 4 |
| C10 | C31 | | | 470pf | | | |
| C11 | C29, C43 | | | 3300pf | | -330 | 2 |
| C12 | C42, C53 | | | 4700pf | | -470 | 2 |
| C13 | C47, C48 | | | .01 | | -01 | 3 |
| C14 | C51, C54 | | | .033uf | | -033 | 2 |
| C15 | C50, C51 | | | .22uf | | -221 | 4 |
| C16 | C3 | | | .33uf | | -331 | 1 |
| C17 | C20, C21 | | | .047uf | | -473 | 2 |
| C18 | C24, C33 | | 50V. .005uf | | CK-502 | 4 |
| C19 | C25, C26 | | .01uf | | CE-103 | 2 |
| C20 | C27, C34 | | 20V. 1uf | | UCE20-105 | 16 |
| C21 | C35, C36 | | | | | |
| C22 | C | | 20V. 100% 10% | ELEC | WHITEER | 30-501-G | 1 |
| C23 | C18 | | .1uf | | | | 1 |
| C24 | C19 | | 47VAR 200V | | | | 1 |
| C25 | C44 | | M | 10% 5% | | | 2 |
| C26 | C52, C37, C41, C42 | ELECTROLYTIC | 450 uf | SPRAGUE | 39D107G450HA4 | 1 |
| C27 | C45, C46 | | 35V. 100uf | SPRAGUE | 19D106G035HA4 | 1 |
| C28 | C7, C8, C40 | VARIABLE | 4.5-25pf | ERIE | 503-001-312 | 3 |
| C29 | | | | | |


HYS/OUTPUT SWITCH
TRIGGER
1ST VCO AMPL EA SUMMING NODE
SHIELD BOARD
OUTPUT AMPL
POWER SUPPLY
VCO (A1)
SWEEP
TRIG OUT
CW
CCW
115V 230V SWITCH (SHOWN IN 115V POSITION)
NOTES: UNLESS OTHERWISE SPECIFIED
1. ★ INDICATES MATCHED SET (R1-4, R5, R10, R11, R27) (R16, R17A) (C109, R110) (R103, R111) (R106, R108)
2. DIODES ARE FDG666
3. RESISTORS ARE CARBON 10%
4. ★ C17, C19, C20 & C24 ARE A MATCHED SET
5. IC2 = CA3039
6. IC2 IC#4 & IC5 ARE SELECTED
7. # INDICATES SELECTED VALUE; NOMINAL VALUE AS SHOWN
8. ZENER DIODES SELECTED. SEE WAVETEK SPEC. 130-506 (CR 19,20,21)
LAST REF DES'G USED
A1
IC68
C68, C82
R10; R40
J1
FREQ COMP (INPUT)
+VCC
OUTPUT
FREQ COMP (OUTPUT)
μA709C
CA3080
CA3036
CA3039
PIN 10 CONNECTED TO CASE
A1 (WAVETEK 130-011)
WAVETEK
SCHEMATIC
VCO BOARD
134
2034 210
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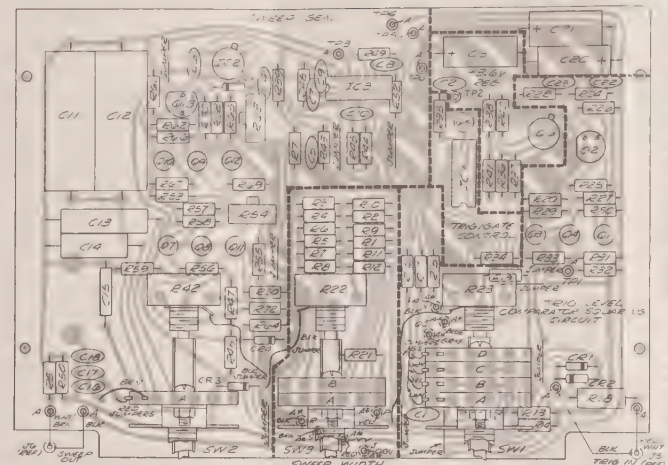
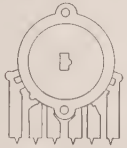



NOTES:
1. JUMPERS FROM BOARD TO SWITCHES, BNC'S AND LUGS ARE STRANDED INSULATED WIRE.
2. LETTERS V,Y,DA,Y,QQ,P,J,E,F,S ARE CONNECTIONS TO THE MAIN BOARD
3. A - INDICATES TERMINALS MOUNTED ON COMPONENT SIDE
4. A INDICATES TERMINAL ON CIRCUIT SIDE




PARTS LIST

| Item | Ref Des | Description | Mfrs By | Mfg No. | Qty |
|---|---|---|---|---|---|
| 6 | C4, 5 | CERAMIC DISC, 20V, .1μF | CRL | UK20-104 | 6 |
| 7 | C6 | SILVER MICA, 5% 68pF | ARCO | CM15-680J | 1 |
| 8 | C18 | 68pF | | 880J | 1 |
| 9 | C1 | 100pF | | 101J | 1 |
| 10 | C17 | 1%, 910pF | | 911F | 1 |
| 11 | C19 | 100V, 1%, .01μF | IMB | PA2B103F | 1 |
| 12 | C9, C10, C20, C21, C23 | CERAMIC DISC, 20V, .1μF | CRL | UK20-104 | 6 |
| 13 | C18 | 100V, 1%, .1μF | IMB | PA2B104F | 1 |
| 14 | C13 | 200V, 1%, .01μF | FASTRON | P10B103SE | 1 |
| 15 | C11, C12 | MATCHED, 200V, 10%, .01μF | | WITK EMITN | 2 |
| 16 | C2 | 5-100pF | ERIE | 538-001 | 1 |
| 17 | C7, C8 | CERAMIC DISC 1000, 47pF | CRL | DD470 | 2 |
| 18 | CR1-CR5 | DIODES FD6666 | FAIRCHILD | FD6666 | 5 |
| 19 | IC3 | INTEGRATED CIRCUITS LINEAR (-15) | RCA | CA3030 | 1 |
| 20 | IC2 | (-31) | RCA | CA3036 | 1 |
| 21 | IC1 | METAL | MOTOROLA | MC1709CG | 1 |
| 22 | R42 | POTENTIOMETERS 500Ω | CTS | MARKII 80A | 1 |
| 23 | R22 | 1K | CTS | 80A | 1 |
| 24 | R23 | 2K | MARITAN | A194-R1A | 3 |
| 25 | R21 | 5K | | | |
| 26 | R20 | 10K | | | |
| 27 | R19 | 20K | | | |
| 28 | R18 | 50K | | | |
| 29 | R17 | 100K | | | |
| 30 | R16 | 200K | | | |
| 31 | R15 | 500K | | | |
| 32 | R14 | 1M | | | |
| 33 | R13 | 2M | | | |
| 34 | J29 | MF 1/4 (ON 46 Ω | CORNING | RNS50 | 1 |
| 35 | P29 | SOCKET, 20 PIN | | 391-CCT-20 | 1 |
| 36 | R60 | 330Ω | | 331E | 1 |
| 37 | R40, R50, R70, R80 | 680Ω | | 681E | 1 |
| 38 | R30, R31, R32, R33, R34 | 1K | | 102K | 5 |
| 39 | R90, R91 | 2K | | 202K | 2 |
| 40 | R92 | 5K | | 502K | 1 |
| 41 | R93, R94, R95, R96, R97, R98 | 2.2K | | 222K | 6 |
| 42 | R99, R100, R101, R102, R103, R104 | 3.3K | | 332K | 8 |
| 43 | R105 | 4.7K | | 472K | 2 |
| 44 | R90 | 5.6K | | 562K | 1 |
| 45 | R91 | 6.8K | | 682K | 1 |
| 46 | R92, R93, R94, R95 | 10K | | 103K | 4 |
| 47 | R96 | 20K | | 203K | 1 |
| 48 | R97, R98, R99, R100 | 47K | | 473K | 2 |
| 49 | R101, R102, R103, R104, R105 | 150K | | 154K | 2 |
| 50 | R106 | 220K | | 224K | 1 |
| 51 | R107 | 5% 68Ω | | 680E | 1 |
| 52 | R108 | 300Ω | | 301E | 2 |
| 53 | R109 | 200K | | 204K | 1 |
| 54 | R110 | 1W, 10%, 10K | | RC32GF 103K | 1 |
| 55 | J30 | MF 1/4 (ON 46 Ω | CORNING | RNS50 | 1 |

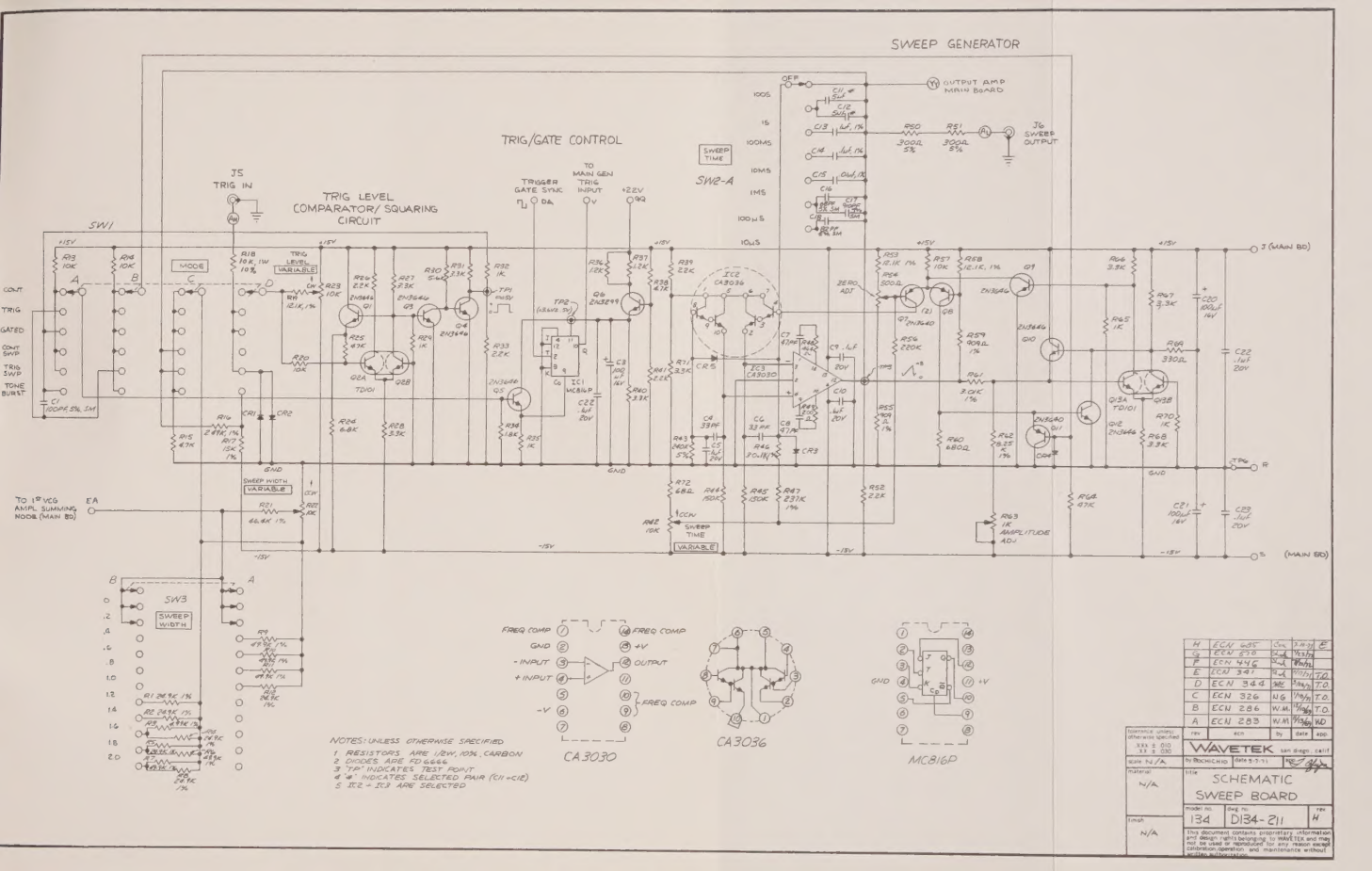
PARTS LIST

| Item | Ref Des | Description | Mfrs By | Mfg No | Qty |
|---|---|---|---|---|---|
| 57 | R16 | 2.49K | | | |
| 58 | R61 | 3.01K | | | |
| 59 | R62 | 8.25K | | | |
| 60 | R19, P53, R56 | 12.1K | | | 3 |
| 61 | R17 | 15K | | | |
| 62 | R1, R2, R4, R5, R6, R8 | 24.9K | | | 6 |
| 63 | R48 | 30.1K | | | |
| 64 | R21 | 46.4K | | | |
| 65 | R3, R7 | 49.9K | | | |
| 66 | R47 | 93K | | | |
| 67 | | | | | |
| 68 | | TRANSISTORS | | | |
| 70 | Q6 | 2N3699 | FAIRCHILD | 2N3699 | 1 |
| 71 | Q1, Q8, Q9 | MPS3640 | MOTOROLA | MPS3640 | 3 |
| 72 | Q2, Q3, Q4, Q5 | 2N3646 | FAIRCHILD | 2N3646 | 7 |
| 73 | Q2, Q13 | TD101 | SPRAGUE | TD101 | 2 |
| 74 | | | | | |
| 75 | | | | | |
| 77 | | MISCELLANEOUS | | | |
| 78 | SW3A | SWITCH WAFER | MARITAN | A34-SW11 | |
| 79 | SW3B | | | | -2 |
| 80 | SW1 SW2 SW3 | | | | |
| 81 | | | | | |
| 82 | | | | | |
| 83 | J, J* | TERMINAL | | | |
| 84 | | CIRCUIT BD | MARITAN | 130-111C | 1 |
| 85 | SW1 | MODIFIED A130-603 | | 2-12-304 | |
| 86 | SW2 | | | | -2 |
| 87 | SW3 | | | | -3 |
| 88 | | | | | |
| 89 | | | | | |
| 90 | | | | | |
| 91 | | | | | |
| 92 | | | | | |
| 93 | | | | | |

WAVETEK

ASSEMBLY SWEEP BOARD

SW 36.01 H




| rev | ecn | by | date | app |
|---|---|---|---|---|
| H | ECN 685 | CM | 3-8-73 | E |
| G | ECN 570 | CM | 9-13-72 | |
| F | ECN 446 | CM | 4-14-72 | |
| E | ECN 344 | RJ | 9-17-71 | T.O. |
| D | ECN 344 | WE | 9-17-71 | T.O. |
| C | ECN 326 | WG | 1-19-71 | T.O. |
| B | ECN 286 | W.M. | 11-6-70 | T.O. |
| A | ECN 283 | W.M. | 9-15-70 | RD |

Tolerance unless otherwise specified: XXX ± .010, XX ± .030

WAVETEK san diego, calif

drawn: N/A | by: ROCHICHIO | date: 5-7-71

material: N/A

finish: N/A

title: SCHEMATIC SWEEP BOARD

model no.: 134 | dwg no.: D134-211 | rev: H

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